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SUMMARY

The first-stage rotor of the NASA two-stage fan was redesigned to account for the presence of the part-span damper. The overall design parameters were unchanged, but significant changes were made to the blade shape. These changes include shaped blading in the end-wall region to account for the inlet boundary layer, reduced suction-surface turning ahead of the passage normal shock, increased choke margin, reduced leading- and trailing-edge thickness, and a different method for setting suction-surface incidence angle on the transonic portions of the blade.

The two-stage fan was tested at 80 and 100 percent of design speed with circumferentially grooved casing treatment over both rotors. Detailed surveys of the flow conditions were made over the entire stable operating flow range. Test results showed that (compared with the original, large damper configuration) the overall efficiency of the two-stage fan was improved 1.9 percentage points to 0.803, but was still 2.8 percentage points lower than design. The efficiency of the first-stage rotor was improved 1.4 percentage points to 0.821, but is lower than design by 4.4 percentage points. Stall margin based on weight flow and pressure ratio at peak efficiency was 10 percent.

INTRODUCTION

The NASA Lewis Research Center has been conducting experimental studies on a two-stage fan (refs. 1 to 3). The design and aerodynamic performance of the fan having a small part-span damper on the first-stage rotor was presented in reference 1. Because of the mechanical failure of the damper, the first-stage rotor was refabricated with a larger damper. The performances of the large damper configuration with and without casing treatment are presented in references 2 and 3. Both damper configurations demonstrated an appreciable drop in efficiency in the region of the damper, compared with design. This drop extends from approximately 20 percent of span to 80 percent of span for both damper configurations. The large damper configuration showed a much greater drop than the small damper configuration. The effect of the presence of the part-span damper was not included in the rotor design calculations.

This report presents the performance of the two-stage fan with a first-stage rotor that was redesigned to account for the presence of the part-span damper. Other design changes were also included in an attempt to improve the performance of the first-stage rotor in general. These changes include end-wall bend in both hub and tip to account for the inlet boundary layer, reduced suction-surface turning ahead of the passage

normal shock, increased choke margin, reduced leading- and trailing-edge thickness, and a different method for setting suction-surface incidence angle on the transonic portion of the blade. Since previous studies (ref. 3) showed an improvement in stall margin with casing treatment, the present fan was tested only with casing treatment. The data in this report are presented in both tabular and plotted form. The symbols and equations are defined in appendixes A and B. The definitions and units used for the tabular data are presented in appendix C.

AERODYNAMIC DESIGN

A detailed discussion of the overall aerodynamic design of the two-stage fan is presented in reference 1. A summary is presented herein along with a detailed description of the redesigned first-stage rotor.

Overall Design

The two-stage fan was designed using the computer program described in reference 4. The overall and stage design parameters are listed in table I. The flow path of the fan is shown in figure 1, and an assembly photograph is shown in figure 2. The fan was designed to produce an overall pressure ratio of 2.4 at an adiabatic efficiency of 0.831. The first-stage design pressure ratio is 1.59 at an adiabatic efficiency of 0.816. The inlet tip speed is 426.55 m/sec at an air flow of 33.248 kg/sec.

First-Stage Rotor Redesign

In an attempt to improve the performance of the two-stage fan, the first-stage rotor was redesigned. Previous versions of this rotor (refs. 1 and 2) did not take into account the radial loss gradient and blockage caused by the part-span damper. The redesigned rotor includes allowances for these effects. The dimensions of the part-span damper were unchanged from the large damper configuration (ref. 3). Additional design changes include:

(1) Blade shaped in the end-wall region to account for the inlet boundary layer
(2) Reduced suction-surface turning ahead of the passage normal shock
(3) Increased choke margin
(4) Reduced leading- and trailing-edge thicknesses
(5) Method of setting suction-surface incidence angle on the transonic portion of the blade (ref. 5).

Since the current compressor design computer program does not accommodate a part-span damper, the first-stage rotor was redesigned utilizing inner and outer flow

paths. The outer flow path extended from the casing to the part-span damper leading-edge stagnation streamline. The inner flow path extended from the part-span damper to the hub (fig. 3). By designing the rotor in this manner, the losses and blockage in the region of the part-span damper could be included in the same way as a wall boundary condition.

The profile losses used in the redesign are compared with the losses in the original design in figure 4(a). The losses are based on those described in reference 1 plus an adjustment in the area of the part-span damper that reflects the data in references 3 and 6.

Boundary-layer blockage allowance is 2 percent at the rotor inlet and 2.6 percent at the rotor exit. Blockages are divided equally between hub and casing. The blockage allowance in the damper region is 5 percent. A gradient in total pressure, based on unreported boundary-layer data - taken from the original large-damper configuration - was input at the rotor leading-edge tip and hub. The total pressure varied from 9.72 newtons per square meter (N/cm^2) at the tip to 10.15 N/cm^2 at 15 percent span from the tip. Inlet total pressure at the hub is 10.11 N/cm^2. The rotor-outlet total pressure was designed to be radially constant (16.49 N/cm^2), which results in the total-pressure ratio being higher in the tip and hub than at mid span (fig. 4(b)). The first-stage rotor was designed to provide 50 percent of the energy input required of the two-stage fan. The aspect ratio of the rotor is 2.9, and the tip solidity is 1.3.

The incidence angles (fig. 4(c)) for the transonic portion of the rotor were determined using the method described in reference 5. Briefly, the method minimizes the expansion and compression wave system at the leading edge of a transonic rotor. This is accomplished by setting the suction-surface blade angle at a point midway between the leading edge and the first captured Mach wave. The blade angle at this point is set equal to the free-stream relative flow angle minus an adjustment for blade and boundary-layer blockage. This adjustment was approximately 1.5° from the tip to 59 percent span. From 59 percent span to the hub the suction-surface incidence angle at the leading edge was zero. The inlet-to-outlet turning ratios for the multiple-circular-arc (MCA) blade sections of the rotor were set in conjunction with the above described method of setting incidence angle to achieve an approximately 5-percent choke margin (fig. 4(d)). The transition point for each of the MCA blade sections was located at the same chordwise location as the predicted passage normal shock.

In an attempt to reduce shock losses, the maximum thicknesses was moved rearward to minimize turning on the suction surface ahead of the passage normal shock (fig. 4(e)). The radial distribution of maximum thickness to chord ratio is linear from tip to hub. The leading- and trailing-edge thicknesses were also reduced significantly from the original design (fig. 4(f)). Leading- and trailing-edge thickness to chord ratios are distributed linearly from tip to hub.

Deviation angles (fig. 4(g)) were set using modified Carter's rule plus an adjustment based on the data in reference 7.

Blade-element design parameters for the redesigned first-stage rotor are listed in table II(a), and in tables II(b) to (d) are contained the blade design parameters for the first-stage stator and the second-stage rotor and stator. Blade geometries for the various fan rows are given in table III.

APPARATUS AND PROCEDURE

Test Fan

The assembled two-stage fan is shown in figure 2. The first- and second-stage rotors have 43 and 38 blades, respectively. The first- and second-stage stators have 34 and 42 blades, respectively. The fan was tested with circumferentially grooved casing treatment over the rotors. The details of the casing treatment are shown in figure 5.

Compressor Test Facility

The two-stage fan was tested in the Lewis multistage compressor facility, which is described in detail in reference 1. A schematic diagram of the facility is shown in figure 6. Atmospheric air enters the test facility at an inlet located on the roof of the building and flows through the flow measuring orifice, through the inlet butterfly throttle valves, and into the plenum chamber upstream of the test compressor. The air then passes through the test fan into the collector and is exhausted either to the atmosphere or to an altitude exhaust system. Mass flow is controlled with a sleeve valve in the collector. For this series of tests the large inlet butterfly throttle valve remained fully open with the small valve fully closed, and the air was exhausted to the atmosphere.

Instrumentation

Radial surveys of the flow conditions were made at the fan inlet and behind the two stator-blade rows (see fig. 1). Total pressure, total temperature, and flow angle were measured with a combination probe (fig. 7). Each probe was positioned with a null-balancing, stream-direction-sensitive control system that automatically alined the probe to the direction of flow. The thermocouple was iron-constantan. All pressures were measured with calibrated transducers. Two combination probes were used at the compressor inlet and behind the first-stage stator, and four combination probes were used behind the second-stage stator. The circumferential locations of the probes at

each measuring station are shown in figure 8. The probes behind the stators were circumferentially traversed one stator-blade passage clockwise from the nominal values shown.

The fan mass flow was determined by means of a calibrated thin-plate orifice. An electronic speed counter, in conjunction with a magnetic pickup, was used to measure rotative speed (rpm).

The estimated errors in the data, based on inherent accuracies of the instrumentation and recording system, are as follows:

Weight flow, kg/sec	±0.3
Rotative speed, rpm	±30
Flow angle, deg	±1
Temperature, K	±0.6
Total pressure, N/cm^2, at -	
Station 1	±0.07
Station 2	±0.10
Station 3	±0.17

Test Procedure

The data were taken over a range of weight flows from maximum to near-stall conditions at equivalent rotative speeds of 80 and 100 percent of design speed. At each selected flow data were recorded at 11 radial positions. At each radial position the combination probes behind the stators (stations 2 and 3) were circumferentially traversed to 10 equally spaced locations across a stator-blade gap. Total pressure, total temperature, and flow angle were measured at each circumferential position. At the fan inlet (station 1) total pressure, total temperature, and flow angle were also measured at each radial position.

Calculation Procedure

At each radial position behind each stator-blade row, circumferential arrays of total pressure, total temperature, and flow angle were generated across a stator-blade gap by arithmetically averaging the measurements from the combination probes at each circumferential position. At each radial position the averaged values making up the circumferential array of total pressure, total temperature, and flow angle across one blade gap were again averaged as follows to obtain the representative radial values (reported herein) behind each stator-blade row. The radial distributions of static pressure were calculated from continuity of weight flow and radial equilibrium. The total-

pressure array was energy averaged, the total-temperature array was mass averaged, and the flow-angle array was arithmetically averaged.

Representative radial values of total pressure and total temperature between the rotor- and stator-blade rows (necessary for individual rotor and stator performance evaluation) were obtained from the averaged circumferential arrays of total pressure and total temperature obtained downstream of the adjoining stator and translated upstream of the stator along design streamlines as follows: At each radial position total temperature was selected as the mass-averaged value of the arithmetically averaged values of the circumferential array, and the highest value of total pressure was selected from the arithmetically averaged values of the circumferential array.

Data were reduced using a computer program that calculates the radial distributions of static pressure at each measuring station and the radial distributions of flow angle at stations behind the rotors. The radial distributions of static pressure are calculated within the program from continuity of mass flow equations and from full radial equilibrium equations, which include gradients of entropy and enthalpy and use design streamline curvature, slope, and endwall blockage. Inputs to this program include equivalent weight flow, corrected speed, and radial distributions of total pressure and total temperature behind a rotor-blade row and equivalent mass flow along with radial distributions of total pressure, total temperature, and flow angle behind a stator-blade row.

To obtain overall performance for each rotor and stage, the radial values of total temperature were mass averaged, and the radial values of total pressure were energy averaged.

All data reported herein have been translated to the leading and trailing edges of each blade row by the method presented in reference 4. All pressures and temperatures were corrected to sea-level conditions based on the inlet conditions of the first-stage rotor. Orifice weight flow was corrected to sea-level conditions based on the inlet conditions of each stage.

RESULTS AND DISCUSSION

The experimental results of the two-stage fan with the redesigned first-stage rotor are presented in three main sections: Overall Performance, Radial Distributions of Performance Parameters, and Effect of Rotor Redesign on Overall and Rotor One Performance. The fan was tested with circumferentially grooved casing treatment over both rotors. All data are presented in tabular form, and the more significant parameters are also presented in plotted form. The overall performance is presented in table IV. The blade-element data are presented in tables V to VIII. The definitions and units used for the tabular data are presented in appendix C.

Overall Performance

Two-stage fan performance. - At design speed the two-stage fan achieved a peak adiabatic efficiency of 0.803 at an equivalent weight flow of 33.33 kg/sec (fig. 9(a)). Design efficiency and weight flow are 0.831 and 33.248 kg/sec, respectively. The corresponding value of total pressure ratio was 2.262 as compared with the design value of 2.40. Stall occurred at an equivalent weight flow of 31.76. Stall margin, based on flow conditions at peak efficiency, was 10 percent.

First-stage performance. - The overall performance of the first stage and rotor are presented in figures 9(b) and (c). At design speed peak efficiency for the stage and rotor occurred at an equivalent weight flow of 32.69 kg/sec as compared with the design weight flow of 33.248 kg/sec.

For the stage the peak adiabatic efficiency value of 0.789 is 2.7 percentage points lower than the design value. The corresponding value of total-pressure ratio was 1.555 as compared with the design value of 1.592.

For the rotor the peak efficiency value of 0.821 was 4.4 percentage points lower than the design value. The corresponding value of total-pressure ratio was 1.582 as compared with the design value of 1.632.

Nondimensional performance. - The nondimensional performances of the first-stage rotor, second stage, and second-stage rotor are presented in figure 10, wherein head-rise coefficient, temperature-rise coefficient, and adiabatic efficiency are plotted as functions of stage flow coefficient. Data at 80 and 100 percent of design speed are plotted along with the design points.

First stage: The nondimensional-performance curves for the first stage and rotor (figs. 10(a) and (b)) show characteristics similar to the dimensional performance curves (figs. 9(b) and (c)).

Second stage: For both stage and rotor the flow coefficient range and efficiency increase with decreasing rotative speed. At design speed the peak measured efficiency occurred at a flow coefficient of 0.503. At 80 percent of design speed the peak measured efficiency occurred at a flow coefficient of 0.474. At design speed the peak measured efficiency for the second stage was 0.844. The design stage efficiency is 0.869. At 80 percent of design speed the peak measured efficiency was 0.867. At design speed the peak measured efficiency for the second-stage rotor was 0.885. The design rotor efficiency is 0.911.

Radial Distributions of Performance Parameters

The radial distributions of selected flow and performance parameters are shown for the first rotor and stator in figures 11 and 12 and for the second rotor and stator in

figures 13 and 14. The results are presented for three equivalent weight flows at design speed. The data shown represent the flow condition of the fan at near stall, peak efficiency, and near choke. Design values are shown by a solid line. In this section the performance results at a weight flow of 33.33 kg/sec (near peak overall efficiency) are compared with the design values.

First stage. - The first-stage rotor demonstrated lower than design efficiency over the entire span (fig. 11). In the region of the part-span damper, however, peak efficiency occurred at the near-stall point. Total-pressure ratio is lower than design over the entire span. Total-temperature ratio, which reflects energy addition, is also somewhat lower than design over the entire span. Suction-surface incidence angles are within 1° of design over the entire span. Deviation angles are near the design values from 5 to 30 percent span and are higher than design from 30 to 90 percent span. The total-loss coefficient is near design from 30 to 50 percent span and much higher than design in both endwall regions. The diffusion factor is slightly lower than design from 5 to 70 percent span and slightly higher than design from 70 to 100 percent span.

The first-stage stator is operating at high negative suction-surface incidence angles from 5 to 70 percent span (fig. 12). Deviation angles for the stator are much lower than design over the entire span. The total-loss coefficient is generally lower than design except in the region downstream of the rotor damper (40 to 50 percent span). The diffusion factor is also lower than design except from 35 to 50 percent span.

Second stage. - The radial distribution of efficiency for the second-stage rotor shows lower than design efficiency from 10 to 30 percent span, higher than design efficiency from 36 to 50 percent span, and lower than design efficiency from 70 to 90 percent span (fig. 13). The total-temperature ratio is near design over the entire span. The total-pressure ratio is higher than design in the midspan region and lower than design from 70 to 95 percent span. Suction-surface incidence angles for the rotor are near design at 5 and 95 percent span, 2° to 3° less than design at 20 and 80 percent. At 42 percent span (in the wake of the part-span damper on the first-stage rotor) the suction-surface incidence angle is approximately 2.5° higher than design. The total-loss coefficient is near design at 5 and 95 percent span, higher than design at 20 and 80 percent span, and lower than design in the midspan region. The diffusion factor is near design over the entire span.

The second-stage stator is operating at suction-surface incidence angles that are from 3° to 7° lower than design over the entire span (fig. 14). Total-loss coefficient is near design over most of the span except from 70 to 95 percent span.

Effect of Rotor Redesign on Performance

Overall performance. - Comparison plots of overall, stage, and rotor performance are presented in figures 15 and 16. The performance of the redesigned rotor is compared with that of the original large-damper configuration (ref. 3), which did not take into account the presence of the part-span damper. The dimensions of the part-span damper were unchanged in the redesign. Both configurations had casing treatment over both rotors.

Figure 15(a) is a comparison of the fan's overall performance before and after the redesign. It shows that the overall adiabatic efficiency of the redesigned fan at design speed was approximately 1.9 percentage points greater than the original design, and that weight flow was higher than, total-pressure ratio was slightly higher than, and total-temperature ratio was nearly the same as design. Similar trends are evident at 80 percent of design speed.

Figures 15(b) and (c) show trends similar to those presented in figure 20. The adiabatic efficiency of the redesigned rotor was improved approximately 1.4 percentage points.

Figure 16, a comparison of the nondimensional overall performances of the second stage before and after the redesign of the first-stage rotor, shows a 2-percentage-point improvement in second-stage efficiency compared with the original configuration. Since this first stage is operating nearer to the design point than the original and since no changes were made to the second stage, it can be concluded that the improvement in efficiency of the second stage is due to improved spanwise matching of the flow entering the second stage.

Radial distributions. - The radial distributions of various performance parameters for the redesigned rotor at a weight flow of 32.69 kg/sec are compared with the original design at a weight flow of 32.26 kg/sec (fig. 17).

The plot of adiabatic efficidncy versus percent span shows 1- to 5-percentage-point improvement for the redesigned rotor in the region of the part-span damper. However, in the tip and hub regions the efficiency of the redesigned rotor is 1.5 to 3 percentage points lower than the original design. Deviation angle and diffusion factor for the redesigned rotor are higher in the tip and hub regions than the original design. The meridional velocity ratio for the redesigned rotor is lower in the tip and hub regions than the original design. The combination of high deviation angle, high diffusion factor, and low meridional velocity ratio are consistent with the low efficiencies in the tip and hub regions of the redesigned rotor.

CONCLUDING REMARKS

Redesign to Account for Part-Span Damper

The radial loss gradient, blockage, and changes in streamline slope and curvature caused by the part-span damper have, all or in part, not been accounted for in the aerodynamic designs of rotors with part-span dampers. This report has presented a method for accounting for the blockage and loss gradient caused by the part-span damper. An improvement of up to 5 percentage points in the area of the part-span damper was achieved. Because of the method used to determine streamline slope and curvature, the effects of the part-span damper on these terms was not accounted for. It is possible that even higher efficiencies can be achieved if the changes in streamline slope and curvature can be accounted for.

Blade Shape to Account for Casing Boundary Layer

The original large damper configuration (refs. 2 and 3) had low efficiency in the tip and hub areas and appeared to be tip critical. Measurements in the outer 10 percent of span showed an increase in the suction-surface incidence angle of 2° to 3°. This increase was due to the low meridional velocity in the casing boundary layer. In an effort to compensate for the casing boundary layer, the measured total-pressure gradient in the tip and hub were used in the redesign. It was hoped that by accounting for the casing boundary layer in that manner and by alining the blade with the actual flow in the tip, an increase in efficiency and stall margin will result. Figure 4 shows that as a result of the various changes made to the rotor tip and hub sections, the efficiency decreased 2 to 3 percentage points compared with the original configuration. It is concluded that more detailed information about the nature of the flow in this area is needed in order to develop a more effective design method.

SUMMARY OF RESULTS

The first-stage rotor of the NASA two-stage fan was redesigned to account for the presence of the part-span damper. The overall design parameters remained unchanged; however, several significant changes were made. These changes include, shaping the blade in the end-wall region to account for the inlet boundary layer, reduced suction-surface turning ahead of the passage normal shock, increased choke margin, reduced leading- and trailing-edge thickness, and a different method for setting the suction-surface incidence angle on the transonic portions of the blade.

The two-stage fan was tested at 80 and 100 percent of design speed with circumferentially grooved casing treatment over both rotors. Detailed surveys of the flow conditions were made over the entire stable operating flow range.

At design speed the following principal results were obtained:

1. Although the overall adiabatic efficiency of the two-stage fan was improved from 0.784 to 0.803, this value is 2.8 percentage points lower than design. The efficiency of the first-stage rotor increased from 0.807 to 0.821, which is lower than design by 4.4 percentage points.

2. The adiabatic efficiency in the region of the part-span damper was improved up to 5 percentage points.

3. Efficiencies in the tip and hub regions decreased from 1 to 3 percentage points.

4. Stall margin for the redesigned two-stage fan was 10 percent, 4 percentage points below the original configuration.

Lewis Research Center,
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APPENDIX A

SYMBOLS

A_{an} annulus area at rotor leading edge, m^2

A_f frontal area at rotor leading edge, m^2

C_p specific heat at constant pressure, 1004 J/(kg)(K)

D diffusion factor

i_{mc} mean incidence angle, angle between inlet air direction and line tangent to blade mean camber line at leading edge, deg

i_{ss} suction-surface incidence angle, angle between inlet air direction and line tangent to blade suction surface at leading edge, deg

N rotative speed, rpm

P total pressure, N/cm^2

p static pressure, N/cm^2

r radius, cm

SM stall margin

T total temperature, K

U wheel speed, m/sec

V air velocity, m/sec

W weight flow, kg/sec

Z axial distance referenced from rotor-blade-hub leading edge, cm

α_c cone angle, deg

α_s slope of streamline, deg

β air angle (angle between air velocity and axial direction), deg

β'_c relative meridional air angle based on cone angle, arctan $(\tan \beta'_m \cos \alpha_c / \cos \alpha_s)$, deg

γ ratio of specific heats

δ ratio of rotor-inlet total pressure to standard pressure of 10.13 N/cm^2

δ^o deviation angle, angle between exit air direction and tangent to blade mean camber line at trailing edge, deg

η efficiency

θ ratio of rotor-inlet total temperature to standard temperature of 288.2 K

κ_{mc} angle between blade mean camber line and meridional plane, deg

κ_{ss} angle between blade suction-surface camber line at leading edge and meridional plane, deg

σ solidity, ratio of chord to spacing

$\overline{\omega}$ total-loss coefficient

$\overline{\omega}_p$ profile-loss coefficient

$\overline{\omega}_s$ shock-loss coefficient

Subscripts:

ad adiabatic (temperature rise)

id ideal

LE blade leading edge

m meridional direction

mom momentum rise

p polytropic

TE blade trailing edge

z axial direction

θ tangential direction

1 instrumentation plane upstream of first rotor

2 instrumentation plane downstream of first rotor

3 instrumentation plane downstream of second stator

Superscript:

' relative to blade

APPENDIX B

EQUATIONS

Suction-surface incidence angle -

$$i_{ss} = (\beta_c')_{LE} - \kappa_{ss} \tag{B1}$$

Mean incidence angle -

$$i_{mc} = (\beta_c')_{LE} - (\kappa_{mc})_{LE} \tag{B2}$$

Deviation angle -

$$\delta^o = (\beta_c')_{TE} - (\kappa_{mc})_{TE} \tag{B3}$$

Diffusion factor -

$$D = 1 - \frac{V_{TE}'}{V_{LE}'} + \left| \frac{(rV_\theta)_{TE} - (rV_\theta)_{LE}}{(r_{TE} + r_{LE})\sigma(V_{LE}')} \right| \tag{B4}$$

Total-loss coefficient -

$$\bar{\omega} = \frac{(P_{id}')_{TE} - P_{TE}'}{P_{LE}' - p_{LE}} \tag{B5}$$

Profile-loss coefficient -

$$\bar{\omega}_p = \bar{\omega} - \bar{\omega}_s \tag{B6}$$

Total-loss parameter -

$$\frac{\bar{\omega} \cos (\beta_m')_{TE}}{2\sigma} \tag{B7}$$

Profile-loss parameter -

$$\frac{\bar{\omega}_p \cos (\beta'_m)_{TE}}{2\sigma} \tag{B8}$$

Adiabatic (temperature rise) efficiency -

$$\eta_{ad} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{T_{TE}}{T_{LE}} - 1} \tag{B9}$$

Momentum-rise efficiency -

$$\eta_{mom} = \frac{\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1}{\frac{(UV_\theta)_{TE} - (UV_\theta)_{LE}}{T_{LE}C_p}} \tag{B10}$$

Equivalent weight flow -

$$\frac{w\sqrt{\theta}}{\delta} \tag{B11}$$

Equivalent rotative speed -

$$\frac{N}{\sqrt{\theta}} \tag{B12}$$

Weight flow per unit annulus area -

$$\frac{\left(\frac{w\sqrt{\theta}}{\delta}\right)}{A_{an}} \tag{B13}$$

Weight flow per unit frontal area -

$$\frac{\left(\frac{w\sqrt{\theta}}{\delta}\right)}{A_f} \tag{B14}$$

Head-rise coefficient -

$$\psi_P = \frac{C_p T_{LE}}{U_{tip}^2}\left[\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma} - 1\right] \tag{B15}$$

Flow coefficient -

$$\varphi = \left(\frac{V_z}{U_{tip}}\right)_{LE} \tag{B16}$$

Stall margin -

$$SM = \left[\frac{\left(\frac{P_{TE}}{P_{LE}}\right)_{stall}}{\left(\frac{P_{TE}}{P_{LE}}\right)_{ref}} \times \frac{\left(\frac{w\sqrt{\theta}}{\delta}\right)_{ref}}{\left(\frac{w\sqrt{\theta}}{\delta}\right)_{stall}} - 1\right] \times 100 \tag{B17}$$

Polytropic efficiency -

$$\eta_p = \frac{\ln\left(\frac{P_{TE}}{P_{LE}}\right)^{(\gamma-1)/\gamma}}{\ln\left(\frac{T_{TE}}{T_{LE}}\right)} \tag{B18}$$

Temperature-rise coefficient -

$$\psi_T = \frac{C_p(T_{LE} - T_{LE})}{U_{tip}^2} \tag{B19}$$

APPENDIX C

DEFINITIONS AND UNITS USED IN TABLES

ABS	absolute
AERO CHORD	aerodynamic chord, cm
BETAM	meridional air angle, deg
CHOKE MARGIN	one less than the ratio of minimum flow area to critical area
CONE ANGLE	angle between axial direction and conical surface representing blade element, deg
DELTA INC	difference between mean camber blade angle and suction-surface blade angle at leading edge, deg
DEV	deviation angle (defined by eq. (B3)), deg
D FACT	diffusion factor (defined by eq. (B4))
EFF	adiabatic efficiency (defined by eq. (B9))
IN	inlet (leading edge of blade)
INCIDENCE	incidence angle (suction surface defined by eq. (B1) and mean defined by eq. (B2)), deg
KIC	angle between the blade mean camber line at the leading edge and the meridional plane, deg
KOC	angle between the blade mean camber line at the trailing edge and the meridional plane, deg
KTC	angle between the blade mean camber line at the transition point and the meridional plane, deg
LOSS COEFF	loss coefficient (total defined by eq. (B5) and profile defined by eq. (B6))
LOSS PARAM	loss parameter (total defined by eq. (B7) and profile defined by eq. (B8))
MERID	meridional
MERID VEL R	meridional velocity ratio
OUT	outlet (trailing edge of blade)
PERCENT SPAN	percent of blade span from tip referenced to first-stage rotor outlet

PHISS	suction-surface camber ahead of assumed shock location, deg
PRESS	pressure, N/cm^2
PROF	profile
RADII	radius, cm
REL	relative to blade
RI	inlet radius (leading edge of blade), cm
RO	outlet radius (trailing edge of blade), cm
RP	radial position
RPM	equivalent rotative speed, rpm
SETTING ANGLE	angle between aerodynamic chord and meridional plane, deg
SOLIDITY	ratio of aerodynamic chord to blade spacing
SPEED	speed, m/sec
SS	suction surface
STREAMLINE SLOPE	slope of streamline, deg
TANG	tangential
TEMP	temperature, K
TI	thickness of blade at leading edge, cm
TM	thickness of blade at maximum thickness, cm
TO	thickness of blade at trailing edge, cm
TOT	total
TOTAL CAMBER	difference between inlet and outlet blade mean camber lines, deg
TURNING RATIO	ratio of radius of curvature of the mean line behind the transition point to the radius of curvature ahead of the transition point on a multiple circular-arc blade section
VEL	velocity, m/sec
WT FLOW	equivalent weight flow, kg/sec
ZI	axial distance to blade leading edge from first rotor leading edge hub, cm

ZMC	axial distance to blade maximum thickness point from first rotor leading edge hub, cm
ZO	axial distance to blade trailing edge from first rotor leading edge hub, cm
ZTC	axial distance to transition point from first rotor leading edge hub, cm

REFERENCES

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TABLE I. - DESIGN OVERALL FAN

PERFORMANCE PARAMETERS

(a) Compressor

TOTAL PRESSURE RATIO.	2.40
TOTAL TEMPERATURE RATIO	1.342
ADIABATIC EFFICIENCY.	0.831
POLYTROPIC EFFICIENCY	0.850
RPM	16042.8
TIP SPEED	426.72
WEIGHT FLOW, KG/SEC	33.248
WEIGHT FLOW/ANNULUS AREA, (KG/SEC)/M^2 . .	195.287

(b) First stage

ROTOR TOTAL PRESSURE RATIO.	1.362
STAGE TOTAL PRESSURE RATIO.	1.590
ROTOR TOTAL TEMPERATURE RATIO	1.174
STAGE TOTAL TEMPERATURE RATIO	1.174
ROTOR ADIABATIC EFFICIENCY.	0.865
STAGE ADIABATIC EFFICIENCY.	0.816
ROTOR POLYTROPIC EFFICIENCY	0.874
STAGE POLYTROPIC EFFICIENCY	0.827
ROTOR HEAD RISE COEFFICIENT	0.239
STAGE HEAD RISE COEFFICIENT	0.225
FLOW COEFFICIENT.	0.445
EQUIVALENT VALUES BASED ON COMPRESSOR INLET	
WT FLOW PER UNIT FRONTAL AREA	164.172
WT FLOW PER UNIT ANNULUS AREA	195.585
WT FLOW	33.248
RPM	16042.800
TIP SPEED	426.549
EQUIVALENT VALUES BASED ON STAGE INLET	
WT FLOW PER UNIT FRONTAL AREA	164.385
WT FLOW PER UNIT ANNULUS AREA	195.838
WT FLOW	33.291
RPM	16042.800
TIP SPEED	426.549

(c) Second stage

ROTOR TOTAL PRESSURE RATIO.	1.537
STAGE TOTAL PRESSURE RATIO.	1.509
ROTOR TOTAL TEMPERATURE RATIO	1.143
STAGE TOTAL TEMPERATURE RATIO	1.143
ROTOR ADIABATIC EFFICIENCY.	0.911
STAGE ADIABATIC EFFICIENCY.	0.870
ROTOR POLYTROPIC EFFICIENCY	0.917
STAGE POLYTROPIC EFFICIENCY	0.877
ROTOR HEAD RISE COEFFICIENT	0.269
STAGE HEAD RISE COEFFICIENT	0.256
FLOW COEFFICIENT.	0.464
EQUIVALENT VALUES BASED ON COMPRESSOR INLET	
WT FLOW PER UNIT FRONTAL AREA	181.801
WT FLOW PER UNIT ANNULUS AREA	261.018
WT FLOW	33.248
RPM	16042.800
TIP SPEED	405.341
EQUIVALENT VALUES BASED ON STAGE INLET	
WT FLOW PER UNIT FRONTAL AREA	123.683
WT FLOW PER UNIT ANNULUS AREA	177.576
WT FLOW	22.620
RPM	14850.154
TIP SPEED	375.207

TABLE II. - DESIGN BLADE-ELEMENT PARAMETERS

(a) First-stage rotor

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	25.390	24.935	.0	43.5	69.9	62.0	288.2	1.203	9.72	1.699
1	24.660	24.263	.0	41.1	66.9	60.7	288.2	1.189	10.00	1.651
2	23.913	23.591	.0	39.8	64.6	59.3	288.2	1.179	10.15	1.627
3	22.425	22.247	.0	40.0	62.3	56.3	288.2	1.173	10.14	1.629
4	20.932	20.903	.0	43.1	60.8	52.1	288.2	1.179	10.14	1.630
5	20.044	20.097	.0	45.0	60.2	48.4	288.2	1.185	10.14	1.630
6	19.172	19.291	.0	45.2	59.8	44.5	288.2	1.184	10.14	1.630
7	18.212	18.216	.0	46.3	58.2	40.0	288.2	1.179	10.14	1.630
8	15.284	15.528	.0	46.1	52.7	25.5	288.2	1.161	10.14	1.630
9	13.658	14.184	.0	47.5	49.9	14.4	288.2	1.159	10.14	1.630
10	11.949	12.840	.0	49.4	47.0	.8	288.2	1.159	10.13	1.631
11	11.051	12.168	.0	50.1	45.5	-6.1	288.2	1.158	10.12	1.632
HUB	10.175	11.496	.0	50.6	43.9	-12.6	288.2	1.158	10.11	1.634

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	156.5	204.4	454.4	315.2	156.5	148.2	.0	140.7	426.5	418.9
1	177.1	203.8	450.5	313.8	177.1	153.5	.0	134.0	414.3	407.6
2	190.4	204.7	444.6	308.3	190.4	157.2	.0	131.1	401.7	396.3
3	197.7	208.9	425.4	287.9	197.7	159.9	.0	134.3	376.7	373.8
4	196.9	216.7	403.0	257.5	196.9	158.3	.0	148.0	351.7	351.2
5	193.1	224.7	388.2	239.1	193.1	158.8	.0	158.9	336.7	337.6
6	187.2	231.2	372.6	228.3	187.2	162.9	.0	164.1	322.1	324.1
7	190.0	234.8	360.2	211.9	190.0	162.2	.0	169.8	306.0	306.0
8	195.6	248.0	322.8	190.4	195.6	171.9	.0	178.9	256.8	260.9
9	193.2	261.7	300.0	182.4	193.2	176.7	.0	193.0	229.5	238.3
10	187.0	280.7	274.4	182.8	187.0	182.8	.0	213.1	200.7	215.7
11	182.4	292.7	260.3	189.0	182.4	187.9	.0	224.4	185.7	204.4
HUB	177.4	305.7	246.4	198.6	177.4	193.9	.0	236.4	170.9	193.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.470	.565	1.365	.871	.470	.410	-10.79	-12.34	.947	1.515
1	.535	.567	1.361	.873	.535	.427	-8.25	-9.37	.867	1.531
2	.578	.572	1.350	.861	.578	.439	-6.20	-7.02	.826	1.533
3	.602	.586	1.295	.808	.602	.449	-3.32	-3.77	.809	1.501
4	.599	.608	1.226	.722	.599	.444	-.78	-1.02	.804	1.464
5	.587	.630	1.180	.671	.587	.445	-.23	.15	.822	1.448
6	.568	.651	1.130	.642	.568	.458	-.69	.83	.870	1.445
7	.577	.663	1.093	.598	.577	.458	-.70	.04	.854	1.432
8	.595	.710	.982	.545	.595	.492	3.87	3.39	.879	1.390
9	.587	.754	.912	.526	.587	.509	7.42	6.04	.915	1.306
10	.567	.816	.832	.531	.567	.531	11.78	8.87	.977	1.210
11	.552	.856	.788	.552	.552	.549	14.45	10.42	1.030	1.144
HUB	.536	.900	.745	.585	.536	.571	17.24	12.04	1.093	1.075

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	3.4	1.1	8.0	.425	.803	.162	.084	.029	.015
1	5.00	3.5	1.0	7.3	.414	.816	.143	.063	.026	.012
2	10.00	3.7	.9	6.4	.413	.832	.128	.049	.024	.009
3	20.00	3.9	.9	4.4	.431	.863	.107	.043	.020	.008
4	30.00	3.5	.4	4.7	.479	.835	.142	.093	.028	.018
5	36.00	3.1	-.1	5.0	.511	.807	.177	.137	.036	.028
6	42.00	2.9	-.4	5.9	.518	.815	.178	.144	.038	.030
7	50.00	3.4	.0	6.6	.545	.834	.162	.135	.035	.029
8	70.00	3.8	.1	8.1	.543	.930	.074	.061	.016	.013
9	80.00	4.0	-.0	9.0	.553	.943	.066	.063	.014	.013
10	90.00	4.9	.1	9.9	.486	.945	.075	.075	.014	.014
11	95.00	5.7	.1	10.6	.433	.949	.075	.075	.013	.013
HUB	100.00	6.7	.2	11.9	.358	.953	.075	.075	.012	.012

TABLE II. - Continued. DESIGN BLADE-ELEMENT

PARAMETERS

(b) First-stage stator

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	24.384	24.384	41.7	.0	41.7	.0	348.2	1.001	16.49	.979
1	23.684	23.700	38.7	.0	38.7	.0	342.9	1.000	16.49	.981
2	23.075	23.124	37.2	.0	37.2	.0	340.0	1.000	16.49	.981
3	21.836	21.932	37.3	.0	37.3	.0	338.0	1.000	16.49	.982
4	20.608	20.753	37.8	.0	37.8	.0	336.3	1.000	16.49	.982
5	19.893	20.070	38.3	.0	38.3	.0	335.6	1.000	16.49	.982
6	19.204	19.414	39.0	.0	39.0	.0	335.2	1.000	16.49	.982
7	18.443	18.695	39.8	.0	39.8	.0	334.7	1.000	16.49	.980
8	16.143	16.545	42.8	.0	42.8	.0	333.6	1.000	16.49	.974
9	14.897	15.401	45.0	.0	45.0	.0	333.4	1.000	16.49	.966
10	13.640	14.265	47.9	.0	47.9	.0	333.3	1.000	16.49	.954
11	13.006	13.703	49.6	.0	49.6	.0	333.2	1.000	16.49	.945
HUB	12.189	12.931	51.9	.0	51.9	.0	333.2	1.000	16.49	.932

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	221.3	174.8	221.3	174.8	165.1	174.8	147.4	.0	.0	.0
1	221.2	174.0	221.2	174.0	172.7	174.0	138.3	.0	.0	.0
2	222.2	173.8	222.2	173.8	176.9	173.8	134.4	.0	.0	.0
3	225.2	174.4	225.2	174.4	179.1	174.4	136.6	.0	.0	.0
4	228.0	175.1	228.0	175.1	180.2	175.1	139.6	.0	.0	.0
5	230.2	175.4	230.2	175.4	180.7	175.4	142.6	.0	.0	.0
6	232.7	175.5	232.7	175.5	181.0	175.5	146.4	.0	.0	.0
7	235.8	175.3	235.8	175.3	181.2	175.3	150.9	.0	.0	.0
8	247.9	173.8	247.9	173.8	181.9	173.8	168.4	.0	.0	.0
9	256.5	171.9	256.5	171.9	181.2	171.9	181.4	.0	.0	.0
10	266.7	169.1	266.7	169.1	178.8	169.1	197.9	.0	.0	.0
11	272.2	167.8	272.2	167.8	176.3	167.8	207.3	.0	.0	.0
HUB	279.7	166.1	279.7	166.1	172.7	166.1	220.0	.0	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MFRID MACH NO IN	MFRID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.614	.478	.614	.478	.458	.478	-.96	.42	1.058	1.101
1	.618	.480	.618	.480	.483	.480	-.58	.52	1.008	1.035
2	.624	.481	.624	.481	.497	.481	-.27	.61	.983	1.004
3	.635	.484	.635	.484	.505	.484	.33	.89	.974	1.000
4	.646	.488	.646	.488	.510	.488	1.02	1.31	.972	1.002
5	.653	.489	.653	.489	.513	.489	1.45	1.61	.970	1.009
6	.661	.490	.661	.490	.514	.490	1.88	1.94	.970	1.021
7	.671	.489	.671	.489	.516	.489	2.39	2.32	.967	1.035
8	.710	.486	.710	.486	.521	.486	4.09	3.51	.956	1.097
9	.738	.481	.738	.481	.522	.481	5.10	4.06	.949	1.146
10	.771	.472	.771	.472	.517	.472	6.12	4.35	.946	1.211
11	.789	.469	.789	.469	.51[illegible]	.469	6.54	4.32	.952	1.250
HUB	.813	.464	.813	.464	.502	.464	7.05	4.21	.962	1.303

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	2.9	-3.0	17.0	.472	.000	.102	.102	.040	.040
1	5.00	3.0	-3.0	13.7	.452	.000	.086	.086	.033	.033
2	10.00	3.0	-3.0	11.7	.443	.000	.080	.080	.030	.030
3	20.00	2.9	-3.0	9.9	.439	.000	.076	.076	.027	.027
4	30.00	2.8	-3.0	9.2	.435	.000	.073	.073	.024	.024
5	36.00	2.8	-3.0	8.9	.437	.000	.072	.072	.023	.023
6	42.00	2.7	-3.0	8.8	.441	.000	.072	.072	.023	.023
7	50.00	2.7	-3.0	8.6	.447	.000	.076	.076	.023	.023
8	70.00	2.5	-3.0	8.9	.475	.000	.093	.093	.024	.024
9	80.00	2.3	-3.0	9.6	.499	.000	.111	.111	.027	.027
10	90.00	2.1	-3.0	11.3	.528	.000	.142	.142	.032	.032
11	95.00	2.0	-3.0	12.8	.542	.000	.163	.163	.035	.035
HUB	100.00	1.8	-3.1	15.0	.560	.000	.192	.191	.039	.038

TABLE II. - Continued. DESIGN BLADE-ELEMENT

PARAMETERS

(c) Second-stage rotor

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	24.127	23.719	.0	38.1	65.4	57.0	348.4	1.153	16.15	1.531
1	23.475	23.143	.0	38.5	64.3	56.7	342.9	1.150	16.17	1.529
2	22.931	22.659	.0	38.8	63.5	56.3	340.0	1.148	16.18	1.528
3	21.827	21.653	.0	39.6	61.9	54.5	338.0	1.144	16.19	1.527
4	20.746	20.664	.0	40.1	60.5	52.1	336.3	1.141	16.19	1.527
5	20.121	20.094	.0	40.7	59.7	50.5	335.6	1.140	16.19	1.527
6	19.521	19.549	.0	41.3	59.0	48.7	335.2	1.139	16.18	1.526
7	18.863	18.954	.0	42.1	58.3	46.4	334.7	1.139	16.16	1.530
8	16.874	17.213	.0	44.5	56.5	37.7	333.6	1.139	16.05	1.540
9	15.791	16.315	.0	46.3	56.0	31.4	333.4	1.141	15.93	1.552
10	14.670	15.447	.0	48.8	56.4	23.2	333.3	1.146	15.73	1.572
11	14.083	15.026	.0	50.1	57.2	18.3	333.2	1.149	15.59	1.586
HUB	13.292	14.453	.0	51.8	58.8	10.9	333.2	1.153	15.38	1.608

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	185.2	218.1	445.7	314.7	185.2	171.5	.0	134.7	405.3	398.5
1	189.6	214.1	437.6	305.6	189.6	167.6	.0	133.3	394.4	388.8
2	192.4	212.2	430.6	297.7	192.4	165.2	.0	133.1	385.2	380.7
3	195.6	212.0	415.6	281.1	195.6	163.4	.0	135.0	366.7	363.8
4	197.1	213.2	400.4	265.6	197.1	163.0	.0	137.5	348.5	347.1
5	197.2	214.8	391.3	256.1	197.2	162.9	.0	140.0	338.0	337.6
6	196.7	216.9	382.4	246.6	196.7	162.8	.0	143.3	327.9	328.4
7	195.5	219.6	372.4	236.4	195.5	163.0	.0	147.2	316.9	318.4
8	187.4	230.9	339.8	208.2	187.4	164.7	.0	161.8	283.5	289.2
9	178.6	239.3	319.8	193.6	178.6	165.2	.0	173.1	265.3	274.1
10	163.6	250.7	295.8	179.7	163.6	165.1	.0	189.7	246.5	259.5
11	152.3	257.8	281.4	174.1	152.3	165.3	.0	197.8	236.6	252.4
HUB	135.5	268.3	261.2	168.9	135.5	165.8	.0	210.9	223.3	242.8

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.508	.560	1.222	.808	.508	.440	-8.40	-6.29	.926	1.514
1	.525	.555	1.212	.791	.525	.434	-6.74	-4.97	.884	1.481
2	.535	.552	1.199	.775	.535	.430	-5.49	-4.00	.859	1.461
3	.547	.554	1.162	.735	.547	.427	-3.38	-2.36	.835	1.440
4	.553	.560	1.123	.698	.553	.428	-1.54	-.87	.827	1.433
5	.554	.566	1.099	.674	.554	.429	-.53	-.03	.826	1.433
6	.553	.572	1.074	.650	.553	.429	.41	.78	.828	1.435
7	.549	.580	1.046	.624	.549	.430	1.43	1.67	.833	1.442
8	.526	.613	.954	.553	.526	.437	4.62	4.51	.879	1.434
9	.501	.637	.896	.515	.501	.440	6.48	6.19	.925	1.391
10	.457	.668	.826	.479	.457	.440	8.45	8.03	1.009	1.336
11	.424	.688	.783	.465	.424	.441	9.49	9.03	1.086	1.301
HUB	.376	.718	.724	.452	.376	.444	10.89	10.44	1.224	1.252

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	2.5	-.0	2.4	.410	.845	.115	.058	.024	.012
1	5.00	2.5	-.0	2.5	.416	.858	.105	.056	.022	.011
2	10.00	2.5	-.0	2.7	.422	.869	.097	.053	.020	.011
3	20.00	2.7	-.0	3.0	.438	.889	.084	.048	.017	.010
4	30.00	3.1	.0	3.4	.452	.909	.071	.040	.015	.008
5	36.00	3.4	.0	3.7	.462	.917	.067	.038	.014	.008
6	42.00	3.8	-.0	4.1	.474	.921	.065	.039	.014	.008
7	50.00	4.1	-.0	4.6	.487	.926	.063	.039	.013	.008
8	70.00	5.1	-.0	6.3	.520	.940	.058	.043	.013	.009
9	80.00	5.4	-.1	7.6	.537	.943	.062	.054	.014	.012
10	90.00	5.2	-.2	9.6	.551	.943	.072	.070	.016	.016
11	95.00	5.0	-.3	11.0	.550	.945	.078	.077	.017	.017
HUB	100.00	4.7	-.3	12.8	.539	.947	.087	.087	.019	.019

TABLE II. - Concluded. DESIGN BLADE-ELEMENT

PARAMETERS

(d) Second-stage stator

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
TIP	23.622	23.622	38.3	.0	38.3	.0	401.5	1.000	24.73	.983
1	23.063	23.084	37.9	.0	37.9	.0	394.3	1.000	24.73	.984
2	22.595	22.631	37.7	.0	37.7	.0	390.2	1.000	24.73	.985
3	21.638	21.703	37.7	.0	37.7	.0	386.7	1.000	24.73	.985
4	20.708	20.796	37.9	.0	37.9	.0	383.6	1.000	24.73	.986
5	20.176	20.276	38.3	.0	38.3	.0	382.4	1.000	24.73	.986
6	19.668	19.782	38.8	.0	38.8	.0	381.8	1.000	24.73	.985
7	19.116	19.245	39.5	.0	39.5	.0	381.2	1.000	24.73	.984
8	17.498	17.679	42.0	.0	42.0	.0	380.0	1.000	24.73	.980
9	16.656	16.876	44.1	.0	44.1	.0	380.4	1.000	24.73	.976
10	15.829	16.107	47.4	.0	47.4	.0	381.8	1.000	24.73	.969
11	15.421	15.739	49.5	.0	49.5	.0	382.7	1.000	24.73	.964
HUB	14.872	15.240	52.5	.0	52.5	.0	384.1	1.000	24.73	.958

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
TIP	217.8	170.8	217.8	170.8	170.8	170.8	135.2	.0	.0	.0
1	217.7	170.2	217.7	170.2	171.8	170.2	133.7	.0	.0	.0
2	218.3	169.8	218.3	169.8	172.7	169.8	133.5	.0	.0	.0
3	220.7	169.8	220.7	169.8	174.5	169.8	135.1	.0	.0	.0
4	223.3	169.9	223.3	169.9	176.2	169.9	137.2	.0	.0	.0
5	225.2	169.9	225.2	169.9	176.8	169.9	139.4	.0	.0	.0
6	227.3	169.8	227.3	169.8	177.1	169.8	142.4	.0	.0	.0
7	229.7	169.6	229.7	169.6	177.3	169.6	146.0	.0	.0	.0
8	238.1	168.7	238.1	168.7	177.0	168.7	159.2	.0	.0	.0
9	243.5	167.7	243.5	167.7	174.7	167.7	169.6	.0	.0	.0
10	249.9	166.4	249.9	166.4	169.0	166.4	184.1	.0	.0	.0
11	253.3	165.9	253.3	165.9	164.4	165.9	192.7	.0	.0	.0
HUB	258.5	165.3	258.5	165.3	157.5	165.3	204.9	.0	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	STREAMLINE SLOPE IN	STREAMLINE SLOPE OUT	MERID VEL R	PEAK SS MACH NO
TIP	.559	.433	.559	.433	.439	.433	-.10	-.03	1.000	.956
1	.565	.436	.565	.436	.446	.436	.20	.20	.990	.942
2	.569	.437	.569	.437	.450	.437	.42	.38	.983	.934
3	.579	.439	.579	.439	.458	.439	.82	.70	.973	.929
4	.589	.441	.589	.441	.464	.441	1.20	.97	.964	.932
5	.595	.442	.595	.442	.467	.442	1.42	1.10	.961	.938
6	.601	.442	.601	.442	.469	.442	1.65	1.22	.959	.949
7	.609	.442	.609	.442	.470	.442	1.92	1.35	.956	.961
8	.634	.440	.634	.440	.471	.440	2.84	1.64	.953	1.010
9	.649	.437	.649	.437	.466	.437	3.43	1.75	.960	1.052
10	.666	.433	.666	.433	.451	.433	4.14	1.85	.984	1.118
11	.675	.431	.675	.431	.438	.431	4.58	1.88	1.009	1.161
HUB	.689	.429	.689	.429	.420	.429	5.21	1.92	1.050	1.225

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
TIP	.00	2.8	-3.0	16.2	.464	.000	.090	.090	.036	.036
1	5.00	2.8	-3.0	13.9	.458	.000	.083	.083	.032	.032
2	10.00	2.7	-3.0	12.3	.455	.000	.078	.078	.030	.030
3	20.00	2.7	-3.0	10.2	.455	.000	.072	.072	.027	.027
4	30.00	2.6	-3.0	9.5	.454	.000	.068	.068	.024	.024
5	36.00	2.6	-3.0	9.3	.457	.000	.068	.068	.023	.023
6	42.00	2.5	-3.0	9.2	.461	.000	.069	.069	.023	.023
7	50.00	2.5	-3.0	9.1	.467	.000	.072	.072	.023	.023
8	70.00	2.4	-3.0	9.5	.489	.000	.084	.084	.025	.025
9	80.00	2.3	-3.0	10.3	.507	.000	.099	.099	.028	.028
10	90.00	2.1	-3.0	12.4	.531	.000	.122	.122	.033	.033
11	95.00	2.1	-3.0	14.3	.543	.000	.136	.136	.036	.036
HUB	100.00	1.9	-3.0	17.0	.559	.000	.154	.154	.039	.039

TABLE III. - BLADE GEOMETRY

(a) First-stage rotor

RP	PERCENT SPAN	RADII RI	RO	BLADE ANGLES KIC	KTC	KOC	DELTA INC	CONE ANGLE
TIP	0.	25.390	24.935	66.33	65.56	53.93	2.28	-12.570
1	5.	24.660	24.263	63.24	61.99	53.33	2.55	-9.832
2	10.	23.913	23.591	60.92	59.24	52.93	2.75	-7.417
3	20.	22.425	22.247	58.45	55.85	51.81	2.94	-3.799
4	30.	20.932	20.903	57.24	52.97	47.41	3.09	-.563
5	36.	20.044	20.097	57.05	51.41	43.32	3.19	1.008
6	42.	19.172	19.291	56.99	49.84	38.52	3.30	2.149
7	50.	18.212	18.216	54.73	47.26	33.40	3.43	.070
8	70.	15.284	15.528	48.94	39.40	17.37	3.62	3.555
9	80.	13.658	14.184	45.95	35.28	5.37	3.99	7.093
10	90.	11.949	12.840	42.20	30.99	-9.09	4.82	11.208
11	95.	11.051	12.168	39.87	29.22	-16.57	5.61	13.670
HUB	100.	10.175	11.496	37.44	27.68	-24.24	6.54	15.797

RP	BLADE THICKNESSES TI	TM	TO	AXIAL DIMENSIONS ZI	ZMC	ZTC	ZO
TIP	.017	.137	.017	1.312	2.530	2.647	3.351
1	.018	.150	.018	1.175	2.547	2.605	3.462
2	.020	.163	.020	1.070	2.553	2.553	3.540
3	.023	.190	.023	.947	2.538	2.426	3.628
4	.025	.216	.025	.859	2.515	2.290	3.743
5	.027	.232	.027	.812	2.497	2.201	3.825
6	.029	.247	.029	.760	2.472	2.101	3.911
7	.031	.263	.031	.662	2.444	1.964	4.010
8	.036	.314	.036	.377	2.379	1.514	4.304
9	.039	.344	.040	.235	2.336	1.242	4.462
10	.043	.378	.044	.096	2.289	.950	4.595
11	.045	.398	.045	.043	2.265	.808	4.636
HUB	.047	.418	.047	-.000	2.243	.673	4.669

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	4.758	64.08	12.40	1.294	.026	3.26	.059
1	4.758	60.93	9.90	1.331	.071	3.94	.055
2	4.761	58.59	7.99	1.372	.159	4.41	.054
3	4.753	55.73	6.64	1.456	.459	4.97	.060
4	4.751	52.77	9.83	1.554	.596	6.20	.051
5	4.750	50.78	13.72	1.620	.714	7.40	.045
6	4.746	48.51	18.37	1.689	.700	8.73	.053
7	4.719	44.96	21.33	1.773	.700	8.70	.053
8	4.718	33.64	31.57	2.096	.885	9.28	.054
9	4.735	26.02	40.59	2.328	.951	9.97	.052
10	4.788	16.81	51.29	2.644	1.015	10.51	.047
11	4.832	12.06	56.44	2.849	1.015	10.38	.036
HUB	4.890	7.24	61.69	3.089	1.000	10.09	.022

(b) First-stage stator

RP	PERCENT SPAN	RADII RI	RO	BLADE ANGLES KIC	KTC	KOC	DELTA INC	CONE ANGLE
TIP	0.	24.384	24.384	38.83	19.39	-16.98	5.92	.057
1	5.	23.684	23.700	35.72	19.54	-13.67	5.96	.167
2	10.	23.075	23.124	34.27	19.86	-11.67	5.96	.499
3	20.	21.836	21.932	34.44	20.90	-9.93	5.91	.983
4	30.	20.608	20.753	34.94	21.86	-9.21	5.83	1.487
5	36.	19.893	20.070	35.49	22.52	-8.92	5.78	1.821
6	42.	19.204	19.414	36.24	23.25	-8.77	5.73	2.158
7	50.	18.443	18.695	37.11	24.08	-8.63	5.67	2.597
8	70.	16.143	16.545	40.35	26.96	-8.93	5.45	4.171
9	80.	14.897	15.401	42.71	28.87	-9.57	5.31	5.242
10	90.	13.640	14.265	45.75	31.09	-11.34	5.14	6.523
11	95.	13.006	13.703	47.57	32.33	-12.80	5.03	7.283
HUB	100.	12.189	12.931	50.04	33.99	-15.04	4.89	7.759

RP	BLADE THICKNESSES TI	TM	TO	AXIAL DIMENSIONS ZI	ZMC	ZTC	ZO
TIP	.150	.460	.150	10.439	13.120	12.280	16.065
1	.145	.453	.145	10.429	13.124	12.164	16.054
2	.140	.447	.140	10.428	13.127	12.100	16.047
3	.130	.435	.130	10.442	13.126	12.056	16.044
4	.121	.423	.120	10.453	13.125	12.008	16.040
5	.115	.416	.114	10.462	13.124	11.987	16.039
6	.110	.410	.109	10.473	13.123	11.969	16.040
7	.104	.402	.103	10.485	13.122	11.950	16.039
8	.086	.380	.085	10.524	13.113	11.879	16.036
9	.077	.368	.075	10.552	13.107	11.842	16.037
10	.067	.357	.066	10.581	13.098	11.797	16.043
11	.062	.351	.061	10.596	13.093	11.769	16.049
HUB	.055	.344	.055	10.615	13.087	11.732	16.058

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	5.728	10.97	55.81	1.271	1.000	23.57	.255
1	5.727	11.01	49.40	1.308	1.000	20.05	.216
2	5.728	11.32	45.95	1.342	1.000	18.12	.195
3	5.731	12.27	44.37	1.417	1.000	17.08	.180
4	5.730	12.88	44.15	1.499	1.000	16.45	.167
5	5.731	13.31	44.40	1.552	1.000	16.25	.160
6	5.733	13.77	45.01	1.607	1.000	16.21	.154
7	5.735	14.28	45.74	1.671	1.000	16.15	.146
8	5.741	15.80	49.28	1.901	1.000	16.21	.124
9	5.748	16.71	52.28	2.053	1.000	16.45	.113
10	5.759	17.42	57.09	2.233	1.000	17.02	.107
11	5.766	17.66	60.37	2.336	1.000	17.43	.108
HUB	5.768	17.84	65.07	2.485	1.000	18.01	.112

TABLE III. - Concluded. BLADE GEOMETRY

(c) Second-stage rotor

RP	PERCENT SPAN	RADII RI	RADII RO	BLADE ANGLES KIC	BLADE ANGLES KTC	BLADE ANGLES KOC	DELTA INC	CONE ANGLE
TIP	0.	24.127	23.719	62.87	58.21	54.40	2.58	-8.877
1	5.	23.475	23.143	61.82	57.64	54.10	2.51	-7.030
2	10.	22.931	22.659	60.96	56.95	53.53	2.51	-5.626
3	20.	21.827	21.653	59.20	54.94	51.39	2.72	-3.398
4	30.	20.746	20.664	57.37	52.69	48.69	3.14	-1.529
5	36.	20.121	20.094	56.30	51.31	46.75	3.45	-.483
6	42.	19.521	19.549	55.27	49.93	44.57	3.77	.490
7	50.	18.863	18.954	54.19	48.36	41.87	4.13	1.524
8	70.	16.974	17.213	51.41	43.46	31.42	5.13	5.035
9	80.	15.791	16.315	50.62	40.95	23.74	5.43	7.348
10	90.	14.670	15.447	51.04	38.80	13.52	5.43	10.276
11	95.	14.083	15.026	52.05	38.05	7.15	5.25	12.111
HUB	100.	13.292	14.453	53.75	37.20	-2.08	4.93	14.340

RP	BLADE THICKNESSES TI	BLADE THICKNESSES TM	BLADE THICKNESSES TO	AXIAL DIMENSIONS ZI	AXIAL DIMENSIONS ZMC	AXIAL DIMENSIONS ZTC	AXIAL DIMENSIONS ZO
TIP	.060	.173	.060	21.996	23.231	23.675	24.615
1	.065	.175	.065	21.961	23.237	23.635	24.649
2	.070	.180	.070	21.929	23.241	23.597	24.684
3	.080	.199	.081	21.855	23.245	23.505	24.774
4	.090	.227	.091	21.774	23.246	23.393	24.870
5	.096	.246	.097	21.724	23.245	23.318	24.930
6	.101	.266	.103	21.676	23.244	23.243	24.992
7	.106	.288	.109	21.622	23.243	23.154	25.064
8	.124	.353	.127	21.452	23.231	22.855	25.295
9	.134	.382	.137	21.360	23.218	22.679	25.425
10	.145	.404	.146	21.270	23.201	22.501	25.560
11	.151	.412	.151	21.226	23.188	22.409	25.623
HUB	.159	.419	.159	21.169	23.169	22.286	25.709

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	5.109	59.14	8.47	1.292	.599	8.23	.054
1	5.105	58.37	7.72	1.325	.635	7.52	.037
2	5.102	57.58	7.43	1.354	.683	7.24	.031
3	5.096	55.48	7.81	1.418	.830	7.51	.034
4	5.095	53.07	8.68	1.488	.963	8.15	.035
5	5.095	51.53	9.55	1.533	1.000	8.62	.035
6	5.095	49.94	10.70	1.577	1.001	9.13	.036
7	5.095	48.05	12.33	1.630	1.002	9.76	.038
8	5.105	41.47	19.98	1.811	1.000	12.01	.050
9	5.116	37.29	26.88	1.927	1.000	13.52	.064
10	5.141	32.49	37.52	2.065	1.000	15.58	.098
11	5.163	29.88	44.90	2.146	1.000	16.95	.132
HUB	5.203	26.15	55.83	2.268	1.000	18.91	.184

(d) Second-stage stator

RP	PERCENT SPAN	RADII RI	RADII RO	BLADE ANGLES KIC	BLADE ANGLES KTC	BLADE ANGLES KOC	DELTA INC	CONE ANGLE
TIP	0.	23.622	23.622	35.59	18.35	-16.16	5.76	.057
1	5.	23.063	23.084	35.14	19.02	-13.86	5.75	.267
2	10.	22.595	22.631	34.96	19.59	-12.26	5.74	.477
3	20.	21.638	21.703	35.05	20.63	-10.23	5.69	.859
4	30.	20.708	20.796	35.27	21.36	-9.46	5.63	1.167
5	36.	20.176	20.276	35.67	21.86	-9.27	5.59	1.339
6	42.	19.668	19.782	36.26	22.41	-9.18	5.54	1.521
7	50.	19.116	19.245	36.97	23.01	-9.11	5.49	1.729
8	70.	17.498	17.679	39.62	25.06	-9.49	5.34	2.426
9	80.	16.656	16.876	41.90	26.44	-10.27	5.24	2.955
10	90.	15.829	16.107	45.32	28.09	-12.42	5.11	3.745
11	95.	15.421	15.739	47.48	28.99	-14.26	5.03	4.295
HUB	100.	14.872	15.240	50.60	30.24	-17.04	4.91	4.971

RP	BLADE THICKNESSES TI	BLADE THICKNESSES TM	BLADE THICKNESSES TO	AXIAL DIMENSIONS ZI	AXIAL DIMENSIONS ZMC	AXIAL DIMENSIONS ZTC	AXIAL DIMENSIONS ZO
TIP	.125	.356	.125	30.085	32.184	31.465	34.451
1	.120	.350	.120	30.093	32.183	31.450	34.446
2	.116	.345	.116	30.100	32.182	31.437	34.442
3	.108	.335	.108	30.112	32.182	31.411	34.438
4	.100	.325	.100	30.119	32.182	31.382	34.436
5	.096	.319	.096	30.123	32.181	31.366	34.435
6	.092	.314	.091	30.129	32.179	31.354	34.434
7	.087	.308	.086	30.136	32.178	31.346	34.433
8	.074	.291	.073	30.162	32.176	31.320	34.437
9	.066	.282	.066	30.181	32.173	31.317	34.440
10	.060	.274	.059	30.205	32.167	31.320	34.449
11	.056	.270	.056	30.217	32.164	31.319	34.456
HUB	.051	.264	.051	30.234	32.158	31.317	34.468

RP	AERO CHORD	SETTING ANGLE	TOTAL CAMBER	SOLIDITY	TURNING RATIO	PHISS	CHOKE MARGIN
TIP	4.427	9.72	51.74	1.253	1.000	21.08	.299
1	4.427	10.64	49.00	1.283	1.000	19.86	.283
2	4.427	11.35	47.22	1.309	1.000	19.06	.271
3	4.427	12.42	45.29	1.366	1.000	18.03	.254
4	4.427	12.92	44.73	1.426	1.000	17.35	.239
5	4.427	13.22	44.93	1.463	1.000	17.20	.232
6	4.427	13.55	45.44	1.500	1.000	17.20	.227
7	4.427	13.95	46.08	1.543	1.000	17.23	.221
8	4.430	15.10	49.11	1.684	1.000	17.68	.205
9	4.431	15.86	52.17	1.766	1.000	18.47	.201
10	4.434	16.53	57.74	1.856	1.000	20.13	.211
11	4.437	16.72	61.74	1.904	1.000	21.34	.224
HUB	4.441	16.94	67.64	1.972	1.000	23.11	.245

TABLE IV. - OVERALL PERFORMANCE

(a) Two-stage fan; 100 percent of design speed

READING NUMBER	821	872	810	833
TOTAL PRESSURE RATIO	2.371	2.389	2.262	2.046
TOTAL TEMPERATURE RATIO	1.351	1.354	1.326	1.297
ADIABATIC EFFICIENCY	.794	.795	.803	.762
POLYTROPIC EFFICIENCY	.817	.818	.824	.784
WEIGHT FLOW	31.76	32.66	33.33	33.54
WHEEL SPEED, RPM	15890.0	16024.9	15897.1	15902.3
PERCENT OF DESIGN SPEED	99.0	99.9	99.1	99.1
DELTA	.921	.916	.915	.914
THETA	.988	.984	.983	.991

(b) First stage; 100 percent of design speed

READING NUMBER	821	872	810	833
ROTOR TOTAL PRESSURE RATIO	1.586	1.582	1.532	1.520
STAGE TOTAL PRESSURE RATIO	1.559	1.555	1.510	1.497
ROTOR TOTAL TEMPERATURE RATIO	1.173	1.171	1.159	1.156
STAGE TOTAL TEMPERATURE RATIO	1.173	1.171	1.158	1.156
ROTOR ADIABATIC EFFICIENCY	.814	.821	.817	.814
STAGE ADIABATIC EFFICIENCY	.783	.789	.789	.783
ROTOR POLYTROPIC EFFICIENCY	.826	.832	.828	.825
STAGE POLYTROPIC EFFICIENCY	.796	.802	.801	.795
ROTOR HEAD RISE COEFFICIENT	.237	.232	.218	.213
STAGE HEAD RISE COEFFICIENT	.227	.222	.210	.205
FLOW COEFFICIENT	.420	.434	.451	.455
EQUIVALENT VALUES BASED ON STAGE INLET				
WEIGHT FLOW	31.79	32.69	33.36	33.58
WEIGHT FLOW PER UNIT ANNULUS AREA	186.70	192.02	195.93	197.21
WEIGHT FLOW PER UNIT FRONTAL AREA	156.83	161.30	164.58	165.66
WHEEL SPEED, RPM	15890.0	16024.9	15897.1	15902.4
TIP SPEED	422.7	426.2	422.8	423.0
PERCENT OF DESIGN SPEED	99.0	99.9	99.1	99.1
CUMULATIVE VALUES				
COMPRESSOR TOTAL PRESSURE RATIO	1.559	1.555	1.510	1.497
COMPRESSOR TOTAL TEMPERATURE RATIO	1.173	1.171	1.158	1.156
COMPRESSOR ADIABATIC EFFICIENCY	.783	.789	.789	.783
COMPRESSOR POLYTROPIC EFFICIENCY	.796	.802	.801	.795

(c) Second stage; 100 percent of design speed

READING NUMBER	821	872	810	833
ROTOR TOTAL PRESSURE RATIO	1.557	1.571	1.528	1.403
STAGE TOTAL PRESSURE RATIO	1.521	1.536	1.499	1.367
ROTOR TOTAL TEMPERATURE RATIO	1.152	1.156	1.145	1.122
STAGE TOTAL TEMPERATURE RATIO	1.152	1.157	1.145	1.122
ROTOR ADIABATIC EFFICIENCY	.885	.881	.885	.829
STAGE ADIABATIC EFFICIENCY	.834	.829	.844	.763
ROTOR POLYTROPIC EFFICIENCY	.892	.889	.892	.837
STAGE POLYTROPIC EFFICIENCY	.844	.839	.853	.773
ROTOR HEAD RISE COEFFICIENT	.294	.295	.277	.218
STAGE HEAD RISE COEFFICIENT	.277	.279	.263	.200
FLOW COEFFICIENT	.457	.471	.503	.514
EQUIVALENT VALUES BASED ON STAGE INLET				
WEIGHT FLOW	22.08	22.74	23.78	24.12
WEIGHT FLOW PER UNIT ANNULUS AREA	173.33	178.50	186.69	189.34
WEIGHT FLOW PER UNIT FRONTAL AREA	120.75	124.35	130.05	131.90
WHEEL SPEED, RPM	14672.2	14811.4	14770.1	14790.6
TIP SPEED	370.7	374.2	373.2	373.7
PERCENT OF DESIGN SPEED	134.4	135.7	135.3	135.5
CUMULATIVE VALUES				
COMPRESSOR TOTAL PRESSURE RATIO	2.371	2.389	2.262	2.046
COMPRESSOR TOTAL TEMPERATURE RATIO	1.351	1.354	1.326	1.297
COMPRESSOR ADIABATIC EFFICIENCY	.794	.795	.803	.762
COMPRESSOR POLYTROPIC EFFICIENCY	.817	.818	.824	.784

TABLE IV. - Concluded. OVERALL PERFORMANCE

(d) Two-stage fan; 80 percent of design speed

READING NUMBER	846	799	858
TOTAL PRESSURE RATIO	1.789	1.749	1.631
TOTAL TEMPERATURE RATIO	1.226	1.208	1.185
ADIABATIC EFFICIENCY	.801	.832	.811
POLYTROPIC EFFICIENCY	.817	.845	.823
WEIGHT FLOW	22.88	25.26	26.93
WHEEL SPEED, RPM	12826.7	12828.8	12818.7
PERCENT OF DESIGN SPEED	80.0	80.0	79.9
DELTA	.946	.943	.934
THETA	.992	.983	.994

(e) First stage; 80 percent of design speed

READING NUMBER	846	799	858
ROTOR TOTAL PRESSURE RATIO	1.376	1.368	1.331
STAGE TOTAL PRESSURE RATIO	1.355	1.354	1.321
ROTOR TOTAL TEMPERATURE RATIO	1.117	1.111	1.100
STAGE TOTAL TEMPERATURE RATIO	1.117	1.111	1.100
ROTOR ADIABATIC EFFICIENCY	.818	.845	.849
STAGE ADIABATIC EFFICIENCY	.775	.817	.826
ROTOR POLYTROPIC EFFICIENCY	.826	.852	.855
STAGE POLYTROPIC EFFICIENCY	.785	.825	.833
ROTOR HEAD RISE COEFFICIENT	.247	.242	.220
STAGE HEAD RISE COEFFICIENT	.234	.233	.214
FLOW COEFFICIENT	.346	.389	.422
EQUIVALENT VALUES BASED ON STAGE INLET			
WEIGHT FLOW	22.89	25.27	26.96
WEIGHT FLOW PER UNIT ANNULUS AREA	134.42	148.45	158.33
WEIGHT FLOW PER UNIT FRONTAL AREA	112.91	124.69	133.00
WHEEL SPEED, RPM	12826.8	12828.8	12818.8
TIP SPEED	341.2	341.2	341.0
PERCENT OF DESIGN SPEED	80.0	80.0	79.9
CUMULATIVE VALUES			
COMPRESSOR TOTAL PRESSURE RATIO	1.355	1.354	1.321
COMPRESSOR TOTAL TEMPERATURE RATIO	1.117	1.111	1.100
COMPRESSOR ADIABATIC EFFICIENCY	.775	.817	.826
COMPRESSOR POLYTROPIC EFFICIENCY	.785	.825	.833

(f) Second stage; 80 percent of design speed

READING NUMBER	846	799	858
ROTOR TOTAL PRESSURE RATIO	1.341	1.309	1.266
STAGE TOTAL PRESSURE RATIO	1.321	1.291	1.235
ROTOR TOTAL TEMPERATURE RATIO	1.098	1.088	1.077
STAGE TOTAL TEMPERATURE RATIO	1.097	1.087	1.077
ROTOR ADIABATIC EFFICIENCY	.893	.912	.905
STAGE ADIABATIC EFFICIENCY	.850	.867	.807
ROTOR POLYTROPIC EFFICIENCY	.897	.916	.908
STAGE POLYTROPIC EFFICIENCY	.856	.871	.812
ROTOR HEAD RISE COEFFICIENT	.279	.253	.219
STAGE HEAD RISE COEFFICIENT	.264	.240	.195
FLOW COEFFICIENT	.423	.474	.524
EQUIVALENT VALUES BASED ON STAGE INLET			
WEIGHT FLOW	17.86	19.67	21.41
WEIGHT FLOW PER UNIT ANNULUS AREA	140.16	154.39	168.03
WEIGHT FLOW PER UNIT FRONTAL AREA	97.64	107.55	117.05
WHEEL SPEED, RPM	12137.2	12172.0	12220.6
TIP SPEED	306.7	307.5	308.8
PERCENT OF DESIGN SPEED	111.2	111.5	111.9
CUMULATIVE VALUES			
COMPRESSOR TOTAL PRESSURE RATIO	1.789	1.749	1.631
COMPRESSOR TOTAL TEMPERATURE RATIO	1.226	1.208	1.185
COMPRESSOR ADIABATIC EFFICIENCY	.801	.832	.811
COMPRESSOR POLYTROPIC EFFICIENCY	.817	.845	.823

TABLE V. - BLADE-ELEMENT DATA AT BLADE EDGES

FOR FIRST-STAGE ROTOR

(a) 100 Percent of design speed; reading 821

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-2.1	43.3	68.7	60.8	288.8	1.202	10.02	1.603
2	23.922	23.599	-1.6	42.6	66.8	58.9	288.6	1.196	10.14	1.599
3	22.433	22.253	-.7	41.4	64.4	55.3	288.8	1.182	10.11	1.617
4	20.937	20.909	-1.6	41.3	63.0	52.4	288.2	1.175	10.14	1.590
5	20.048	20.102	-2.0	42.0	62.4	50.6	288.0	1.171	10.15	1.565
6	19.177	19.296	-1.9	43.0	61.7	48.0	288.1	1.169	10.15	1.547
7	18.214	18.219	-2.0	45.5	59.6	44.6	288.1	1.167	10.15	1.557
8	15.286	15.530	-1.7	47.7	54.3	29.8	287.6	1.157	10.15	1.603
9	13.660	14.186	-1.8	49.9	51.6	19.1	287.5	1.154	10.15	1.581
10	11.951	12.840	-1.8	54.1	48.6	1.4	287.6	1.159	10.15	1.585
11	11.052	12.169	-2.0	56.0	47.1	-7.8	287.8	1.160	10.14	1.577

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	162.1	202.7	445.8	302.1	162.0	147.4	-6.0	139.1	409.4	402.8
2	172.9	207.2	438.5	295.1	172.8	152.5	-4.7	140.3	398.3	392.9
3	179.9	212.5	416.6	280.1	179.9	159.5	-2.1	140.4	373.7	370.6
4	179.8	212.7	396.6	261.9	179.7	159.7	-5.0	140.4	348.5	348.0
5	177.9	212.6	383.4	248.8	177.8	158.0	-6.1	142.3	333.6	334.5
6	175.1	214.5	368.6	234.6	175.0	156.9	-5.7	146.3	318.7	320.7
7	181.0	215.4	357.7	212.0	180.9	151.0	-6.2	153.6	302.4	302.5
8	187.4	230.1	320.8	178.6	187.3	154.9	-5.5	170.2	255.0	259.0
9	185.5	239.7	298.3	163.3	185.4	154.4	-5.7	183.3	227.9	236.7
10	180.3	259.0	272.5	151.9	180.2	151.9	-5.7	209.8	198.8	213.5
11	176.5	269.0	259.2	152.0	176.4	150.6	-6.1	222.9	183.8	202.4

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.487	.560	1.339	.834	.486	.407	.910	1.570
2	.521	.574	1.322	.818	.521	.423	.882	1.579
3	.543	.594	1.258	.783	.543	.446	.887	1.538
4	.544	.597	1.199	.735	.543	.448	.889	1.519
5	.538	.598	1.159	.700	.537	.444	.888	1.507
6	.529	.604	1.113	.661	.528	.442	.897	1.496
7	.547	.607	1.082	.598	.547	.426	.835	1.475
8	.569	.656	.974	.509	.568	.441	.827	1.430
9	.563	.687	.905	.468	.562	.442	.833	1.348
10	.546	.746	.825	.438	.546	.437	.843	1.244
11	.534	.778	.783	.439	.533	.435	.854	1.180

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	5.3	2.8	7.4	.444	.716	.233	.147	.043	.027
2	10.00	5.8	3.0	5.9	.447	.731	.220	.135	.041	.025
3	20.00	6.0	3.0	3.5	.445	.810	.158	.091	.031	.018
4	30.00	5.8	2.7	5.0	.457	.812	.160	.106	.031	.021
5	36.00	5.3	2.1	7.2	.471	.797	.177	.130	.035	.025
6	42.00	4.8	1.5	9.5	.486	.789	.191	.151	.038	.030
7	50.00	4.9	1.5	11.2	.533	.807	.180	.147	.036	.029
8	70.00	5.3	1.7	12.5	.575	.920	.083	.067	.017	.014
9	80.00	5.6	1.6	13.7	.591	.907	.106	.101	.022	.021
10	90.00	6.5	1.6	10.5	.597	.885	.155	.155	.029	.029
11	95.00	7.3	1.7	8.9	.576	.871	.191	.191	.033	.033

TABLE V. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE ROTOR

(b) 100 Percent of design speed; reading 872

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-.3	42.6	67.9	60.5	289.0	1.197	10.01	1.596
2	23.922	23.599	-.3	40.8	65.9	58.1	286.7	1.190	10.14	1.600
3	22.433	22.253	.3	39.5	63.5	54.6	288.6	1.176	10.12	1.608
4	20.937	20.909	-.6	40.2	62.1	51.8	288.1	1.172	10.14	1.583
5	20.048	20.102	-.7	41.3	61.4	50.0	288.1	1.170	10.15	1.556
6	19.177	19.296	-.4	42.6	60.6	47.6	288.1	1.167	10.15	1.534
7	18.214	18.219	-.8	45.1	58.6	44.4	287.9	1.166	10.15	1.542
8	15.286	15.530	-.5	47.0	52.9	28.4	287.6	1.158	10.15	1.612
9	13.660	14.186	-.6	48.9	50.1	17.8	287.5	1.154	10.15	1.590
10	11.951	12.840	-.5	52.9	47.1	2.0	287.8	1.157	10.15	1.584
11	11.052	12.169	-.7	55.4	45.6	-7.4	287.9	1.160	10.14	1.572

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	168.4	206.5	448.5	308.3	168.4	152.0	-1.0	139.8	414.7	408.0
2	180.1	212.0	440.9	303.5	180.1	160.5	-.8	138.5	401.6	396.2
3	187.6	216.8	419.9	289.0	187.6	167.3	.8	137.8	376.5	373.5
4	187.2	217.0	399.5	267.7	187.2	165.7	-2.0	140.2	351.0	350.5
5	185.0	217.2	386.5	253.9	185.0	163.1	-2.3	143.4	337.0	337.9
6	181.8	218.4	370.6	238.0	181.8	160.6	-1.4	148.0	321.6	323.6
7	188.1	218.4	360.9	215.9	188.1	154.3	-2.5	154.6	305.5	305.6
8	195.1	236.8	323.5	183.4	195.1	161.4	-1.8	173.3	256.3	260.4
9	193.1	246.6	301.1	170.5	193.1	162.3	-1.9	185.7	229.2	238.0
10	187.7	263.2	275.8	158.9	187.7	158.8	-1.6	209.9	200.4	215.3
11	183.7	272.7	262.5	156.3	183.7	154.9	-2.1	224.4	185.4	204.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.507	.572	1.349	.853	.507	.421	.903	1.554
2	.544	.590	1.332	.845	.544	.447	.891	1.558
3	.568	.608	1.272	.811	.568	.469	.892	1.518
4	.567	.611	1.211	.753	.567	.466	.885	1.495
5	.560	.612	1.171	.715	.560	.459	.882	1.483
6	.550	.616	1.122	.672	.550	.453	.884	1.467
7	.571	.617	1.095	.610	.571	.436	.820	1.448
8	.594	.676	.984	.524	.594	.461	.827	1.400
9	.587	.708	.916	.490	.587	.466	.840	1.319
10	.569	.760	.837	.459	.569	.459	.846	1.219
11	.557	.790	.795	.452	.557	.449	.843	1.157

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.6	2.0	7.1	.430	.726	.220	.136	.041	.025
2	10.00	4.9	2.1	5.1	.426	.756	.194	.112	.037	.022
3	20.00	5.0	2.1	2.8	.423	.825	.141	.076	.028	.015
4	30.00	4.8	1.7	4.3	.444	.815	.155	.103	.031	.020
5	36.00	4.4	1.2	6.7	.460	.795	.176	.131	.035	.026
6	42.00	3.7	.4	9.0	.478	.780	.196	.160	.039	.032
7	50.00	3.9	.4	11.0	.525	.793	.188	.157	.038	.032
8	70.00	4.0	.4	11.0	.563	.927	.075	.061	.016	.013
9	80.00	4.2	.2	12.4	.570	.918	.092	.088	.019	.018
10	90.00	5.0	.1	11.0	.574	.893	.141	.141	.027	.027
11	95.00	5.8	.2	9.2	.563	.865	.195	.195	.034	.034

TABLE V. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE ROTOR

(c) 100 Percent of design speed; reading 810

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-1.6	37.5	67.2	60.0	289.2	1.179	10.02	1.534
2	23.922	23.599	-1.5	35.4	65.3	58.2	288.6	1.169	10.14	1.537
3	22.433	22.253	-1.3	34.3	62.9	55.2	288.6	1.158	10.13	1.549
4	20.937	20.909	-1.8	36.4	61.5	52.7	288.2	1.158	10.15	1.515
5	20.048	20.102	-1.6	38.3	60.7	51.2	288.2	1.156	10.15	1.485
6	19.177	19.296	-1.5	39.7	60.0	49.1	288.0	1.155	10.15	1.465
7	18.214	18.219	-1.5	42.0	57.9	45.8	287.8	1.154	10.15	1.482
8	15.286	15.530	-1.2	44.5	52.1	28.8	287.7	1.152	10.15	1.584
9	13.660	14.186	-1.2	47.0	49.3	17.9	287.6	1.151	10.15	1.573
10	11.951	12.840	-1.2	50.9	46.4	2.8	287.6	1.155	10.14	1.559
11	11.052	12.169	-1.6	52.5	45.1	-5.6	287.7	1.157	10.13	1.563

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	174.5	203.5	450.5	323.2	174.4	161.5	-5.0	123.7	410.3	403.7
2	185.7	207.4	443.5	320.8	185.7	169.1	-4.8	120.0	398.0	392.6
3	193.4	211.7	424.5	306.2	193.4	174.9	-4.3	119.2	373.6	370.6
4	192.9	210.9	403.6	280.3	192.8	169.8	-6.0	125.1	348.6	348.1
5	190.4	210.0	389.0	262.8	190.3	164.8	-5.4	130.1	333.9	334.8
6	187.0	210.7	374.3	247.5	186.9	162.2	-4.8	134.5	319.5	321.5
7	193.6	212.1	364.5	225.8	193.6	157.6	-5.1	142.0	303.7	303.8
8	201.1	236.5	327.6	192.5	201.1	168.7	-4.3	165.7	254.3	258.4
9	199.1	247.9	305.2	177.7	199.0	169.1	-4.3	181.3	227.1	235.8
10	193.4	264.4	280.3	166.9	193.3	166.7	-4.2	205.2	198.7	213.5
11	189.1	276.5	267.7	169.3	189.0	168.5	-5.3	219.2	184.2	202.8

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.526	.567	1.357	.901	.526	.450	.926	1.537
2	.562	.582	1.343	.900	.562	.475	.911	1.546
3	.587	.598	1.288	.865	.587	.494	.904	1.514
4	.586	.596	1.226	.792	.586	.480	.881	1.487
5	.578	.594	1.180	.743	.577	.466	.866	1.467
6	.567	.597	1.135	.701	.567	.459	.868	1.456
7	.589	.601	1.108	.640	.588	.447	.814	1.433
8	.613	.677	.999	.551	.613	.483	.839	1.394
9	.607	.713	.930	.511	.606	.487	.850	1.313
10	.588	.765	.852	.483	.588	.482	.862	1.221
11	.574	.803	.813	.492	.574	.490	.891	1.168

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.9	1.3	6.6	.389	.727	.202	.120	.038	.023
2	10.00	4.3	1.5	5.2	.379	.773	.164	.083	.031	.016
3	20.00	4.4	1.5	3.4	.378	.845	.113	.046	.022	.009
4	30.00	4.2	1.1	5.3	.410	.801	.152	.099	.030	.019
5	36.00	3.7	.5	7.8	.432	.765	.185	.142	.036	.028
6	42.00	3.1	-.2	10.5	.449	.746	.208	.172	.040	.033
7	50.00	3.2	-.2	12.3	.494	.772	.191	.162	.038	.032
8	70.00	3.2	-.4	11.4	.537	.925	.074	.059	.015	.012
9	80.00	3.4	-.6	12.5	.551	.913	.094	.090	.019	.018
10	90.00	4.2	-.6	11.9	.551	.875	.157	.157	.030	.030
11	95.00	5.3	-.3	11.1	.521	.868	.182	.182	.032	.032

TABLE V. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE ROTOR

(d) 100 Percent of design speed; reading 833

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-1.3	36.3	67.1	59.8	288.9	1.174	10.01	1.523
2	23.922	23.599	-1.3	34.3	65.0	58.0	288.9	1.165	10.14	1.522
3	22.433	22.253	-1.2	33.3	62.7	55.2	288.5	1.154	10.13	1.534
4	20.937	20.909	-1.6	35.6	61.2	52.8	288.3	1.154	10.15	1.494
5	20.043	20.102	-1.6	37.4	60.5	51.4	288.1	1.153	10.15	1.463
6	19.177	19.296	-1.5	38.9	59.8	49.2	287.9	1.152	10.15	1.446
7	18.214	18.219	-1.4	41.5	57.6	45.8	287.9	1.152	10.15	1.463
8	15.286	15.530	-1.0	44.2	51.8	28.4	287.6	1.152	10.15	1.582
9	13.660	14.186	-1.1	46.4	49.0	17.2	287.7	1.152	10.15	1.578
10	11.951	12.840	-1.1	50.1	46.0	3.0	287.7	1.154	10.14	1.558
11	11.052	12.169	-1.4	51.7	44.6	-4.9	287.8	1.155	10.13	1.551

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	175.7	204.8	450.7	327.9	175.7	165.2	-4.1	121.1	411.0	404.4
2	187.6	208.4	443.6	324.6	187.6	172.2	-4.3	117.4	397.9	392.6
3	195.6	211.9	426.0	310.7	195.6	177.2	-4.0	116.2	374.5	371.4
4	194.9	210.4	404.3	283.1	194.8	171.0	-5.6	122.6	348.7	348.2
5	192.2	208.9	389.9	266.0	192.1	165.9	-5.2	127.0	334.1	334.9
6	188.8	210.4	375.2	250.5	188.7	163.8	-4.8	132.0	319.5	321.4
7	195.6	211.9	364.8	227.5	195.5	158.7	-4.6	140.4	303.4	303.4
8	203.1	238.8	328.8	194.5	203.1	171.2	-3.6	166.6	254.9	259.0
9	201.1	251.6	306.3	181.8	201.0	173.6	-4.0	182.1	227.2	235.9
10	195.4	266.7	281.3	171.4	195.3	171.1	-3.7	204.5	198.8	213.5
11	191.1	276.3	268.3	171.8	191.0	171.2	-4.7	216.9	183.8	202.3

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.530	.573	1.359	.917	.530	.462	.940	1.534
2	.568	.586	1.344	.912	.568	.484	.918	1.539
3	.594	.600	1.294	.880	.594	.502	.906	1.512
4	.592	.596	1.228	.801	.592	.484	.878	1.481
5	.584	.592	1.184	.753	.584	.470	.863	1.462
6	.573	.596	1.138	.710	.573	.464	.868	1.451
7	.595	.601	1.110	.645	.595	.450	.812	1.423
8	.620	.685	1.003	.557	.620	.491	.843	1.386
9	.613	.725	.934	.524	.613	.500	.864	1.309
10	.594	.772	.856	.496	.594	.496	.876	1.216
11	.580	.803	.815	.500	.580	.498	.896	1.158

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.7	1.1	6.4	.376	.733	.192	.111	.036	.021
2	10.00	4.0	1.3	5.0	.368	.775	.159	.079	.031	.015
3	20.00	4.2	1.3	3.4	.367	.846	.108	.041	.021	.008
4	30.00	4.0	.9	5.4	.402	.791	.156	.105	.030	.020
5	36.00	3.4	.2	8.1	.423	.752	.191	.148	.037	.029
6	42.00	2.9	-.4	10.6	.441	.733	.214	.179	.041	.035
7	50.00	2.9	-.6	12.3	.488	.755	.202	.174	.040	.034
8	70.00	2.9	-.7	11.0	.533	.920	.078	.063	.016	.013
9	80.00	3.0	-.9	11.8	.539	.917	.090	.086	.019	.018
10	90.00	3.9	-.9	12.1	.536	.879	.150	.150	.028	.028
11	95.00	4.8	-.8	11.8	.511	.863	.185	.185	.032	.032

TABLE V. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE ROTOR

(e) 80 Percent of design speed; reading 846

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-5.8	45.5	72.9	62.7	289.5	1.138	10.05	1.395
2	23.922	23.599	-4.0	46.6	70.8	61.7	289.1	1.134	10.13	1.381
3	22.433	22.253	-4.5	44.8	68.8	58.8	288.3	1.125	10.14	1.378
4	20.937	20.909	-4.9	43.3	67.7	55.3	287.9	1.118	10.14	1.380
5	20.048	20.102	-4.4	44.4	66.9	52.7	287.9	1.117	10.14	1.377
6	19.177	19.296	-3.9	45.9	66.1	49.6	287.8	1.116	10.14	1.374
7	18.214	18.219	-3.8	48.6	64.4	46.7	287.8	1.114	10.14	1.371
8	15.286	15.530	-3.8	50.0	59.8	33.0	287.8	1.104	10.14	1.368
9	13.660	14.186	-4.5	51.0	57.5	20.5	287.6	1.103	10.14	1.372
10	11.951	12.840	-4.4	55.4	54.8	2.5	287.8	1.105	10.14	1.378
11	11.052	12.169	-3.7	59.2	53.1	-8.8	287.8	1.106	10.14	1.368

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	105.5	157.0	356.9	239.9	104.9	110.0	-10.6	112.0	330.5	325.2
2	114.4	157.6	347.7	228.8	114.1	108.3	-8.0	114.5	320.4	316.1
3	120.3	158.6	332.1	217.3	119.9	112.5	-9.5	111.9	300.2	297.8
4	120.2	161.9	315.7	207.1	119.8	117.8	-10.3	111.1	281.8	281.4
5	119.4	165.6	303.7	195.2	119.1	118.4	-9.1	115.8	270.3	271.0
6	118.0	169.1	290.9	181.5	117.7	117.7	-7.9	121.4	258.0	259.6
7	121.4	168.2	280.1	162.5	121.1	111.3	-8.1	126.1	244.4	244.5
8	124.8	176.9	247.9	135.4	124.5	113.6	-8.4	135.6	206.0	209.3
9	123.5	187.9	228.8	126.1	123.1	118.2	-9.8	146.1	183.1	190.2
10	120.3	203.4	207.8	115.7	119.9	115.6	-9.2	167.4	160.6	172.5
11	117.7	210.0	195.5	108.8	117.5	107.6	-7.7	180.4	148.6	163.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.312	.440	1.056	.672	.311	.308	1.048	1.487
2	.339	.443	1.032	.643	.339	.304	.949	1.495
3	.358	.448	.988	.614	.357	.318	.938	1.499
4	.358	.460	.940	.588	.357	.334	.983	1.463
5	.355	.471	.904	.555	.354	.337	.994	1.422
6	.351	.482	.866	.517	.350	.335	1.000	1.379
7	.362	.479	.834	.463	.361	.317	.919	1.336
8	.372	.508	.739	.389	.371	.326	.912	1.225
9	.368	.542	.682	.364	.367	.341	.960	1.152
10	.358	.588	.619	.335	.357	.334	.964	1.063
11	.350	.609	.582	.315	.350	.312	.916	.994

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	9.6	7.0	9.3	.456	.726	.216	.184	.037	.032
2	10.00	9.8	7.1	8.8	.470	.722	.221	.191	.038	.033
3	20.00	10.4	7.4	7.0	.471	.767	.188	.162	.033	.029
4	30.00	10.5	7.4	7.9	.468	.818	.150	.133	.028	.024
5	36.00	9.9	6.7	9.3	.485	.822	.155	.145	.029	.027
6	42.00	9.2	5.9	11.0	.508	.820	.166	.161	.032	.031
7	50.00	9.6	6.2	13.3	.555	.831	.161	.159	.031	.031
8	70.00	10.9	7.3	15.6	.593	.904	.103	.103	.021	.021
9	80.00	11.5	7.5	15.0	.598	.922	.095	.095	.019	.019
10	90.00	12.6	7.8	11.6	.609	.914	.126	.126	.024	.024
11	95.00	13.3	7.7	7.8	.619	.885	.191	.191	.033	.033

TABLE V. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE ROTOR

(f) 80 Percent of design speed; reading 799

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-2.5	41.0	70.4	60.4	289.6	1.127	10.05	1.382
2	23.922	23.599	-1.9	40.5	68.5	59.0	289.1	1.122	10.13	1.373
3	22.433	22.253	-3.0	37.4	66.4	56.0	288.3	1.112	10.14	1.381
4	20.937	20.909	-3.5	38.2	65.0	52.8	288.0	1.110	10.14	1.371
5	20.048	20.102	-3.2	40.4	64.3	50.6	287.8	1.111	10.14	1.363
6	19.177	19.296	-2.8	42.4	63.5	47.7	287.7	1.112	10.14	1.359
7	18.214	18.219	-3.0	45.4	61.7	45.0	287.6	1.111	10.14	1.358
8	15.286	15.530	-3.2	47.4	56.8	31.4	287.7	1.102	10.14	1.363
9	13.660	14.186	-3.8	49.2	54.5	20.4	287.9	1.101	10.14	1.363
10	11.951	12.840	-3.4	53.5	51.6	2.3	287.7	1.105	10.14	1.370
11	11.052	12.169	-3.8	55.0	50.1	-6.5	288.0	1.105	10.13	1.367

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	120.2	164.3	357.3	250.8	120.1	124.0	-5.2	107.8	331.2	325.9
2	128.8	165.9	350.9	245.0	128.7	126.2	-4.4	107.7	322.1	317.7
3	134.7	167.1	336.1	237.7	134.5	132.8	-7.1	101.5	301.0	298.6
4	134.6	169.0	318.3	220.1	134.4	132.9	-8.3	104.5	280.2	279.9
5	133.5	171.2	307.2	205.7	133.3	130.5	-7.5	110.9	269.2	270.0
6	131.9	174.8	295.7	191.7	131.7	129.0	-6.5	118.0	258.2	259.8
7	135.7	173.4	286.2	172.0	135.5	121.7	-7.0	123.6	245.0	245.1
8	139.4	181.3	254.3	143.8	139.2	122.8	-7.9	133.4	204.9	208.2
9	138.0	191.0	237.0	133.2	137.7	124.9	-9.1	144.5	183.8	190.9
10	134.2	208.8	215.6	124.2	134.0	124.1	-8.0	167.9	160.9	172.8
11	131.3	216.7	204.5	125.2	131.1	124.4	-8.7	177.4	148.3	163.3

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.357	.463	1.060	.707	.356	.350	1.032	1.401
2	.383	.469	1.044	.693	.383	.357	.980	1.420
3	.402	.476	1.003	.677	.401	.378	.988	1.435
4	.402	.483	.950	.628	.401	.379	.989	1.393
5	.399	.489	.917	.588	.398	.373	.979	1.361
6	.394	.500	.883	.548	.393	.369	.979	1.329
7	.406	.496	.855	.492	.405	.348	.898	1.293
8	.417	.522	.761	.414	.416	.353	.882	1.183
9	.413	.551	.708	.384	.412	.360	.907	1.125
10	.401	.605	.644	.360	.400	.360	.926	1.036
11	.392	.629	.610	.364	.391	.361	.949	.982

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	7.0	4.5	7.0	.416	.765	.173	.152	.032	.028
2	10.00	7.5	4.7	6.1	.418	.775	.165	.143	.031	.027
3	20.00	8.0	5.0	4.2	.403	.862	.100	.081	.019	.015
4	30.00	7.8	4.7	5.4	.423	.862	.106	.095	.021	.019
5	36.00	7.2	4.0	7.3	.449	.837	.133	.126	.026	.025
6	42.00	6.6	3.3	9.1	.477	.822	.154	.151	.031	.030
7	50.00	7.0	3.6	11.5	.528	.826	.156	.155	.031	.031
8	70.00	7.9	4.3	14.0	.568	.909	.092	.092	.019	.019
9	80.00	8.5	4.5	14.9	.580	.916	.095	.095	.019	.019
10	90.00	9.4	4.6	11.3	.583	.900	.138	.138	.026	.026
11	95.00	10.4	4.8	10.2	.555	.892	.163	.163	.028	.028

TABLE V. - Concluded. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE ROTOR

(g) 80 Percent of design speed; reading 858

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	24.668	24.270	-2.2	34.4	68.8	59.7	289.6	1.110	10.05	1.324
2	23.922	23.599	-1.9	32.3	66.9	57.8	289.2	1.103	10.13	1.328
3	22.433	22.253	-2.8	30.6	64.7	54.9	288.2	1.098	10.14	1.332
4	20.937	20.909	-2.6	33.0	63.2	52.1	287.8	1.098	10.15	1.324
5	20.048	20.102	-2.4	34.9	62.2	49.7	287.7	1.099	10.15	1.312
6	19.177	19.296	-2.3	36.6	61.6	47.2	287.6	1.100	10.15	1.306
7	18.214	18.219	-2.3	39.4	59.7	44.1	287.6	1.100	10.15	1.314
8	15.286	15.530	-2.5	46.6	54.4	33.7	287.7	1.097	10.15	1.347
9	13.660	14.186	-2.6	43.4	51.9	17.3	287.7	1.099	10.15	1.353
10	11.951	12.840	-36.1	22.1	61.6	30.2	288.5	1.100	10.05	1.376
11	11.052	12.169	.0	74.2	45.4	-21.5	287.8	1.104	10.14	1.366

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	130.8	164.8	360.9	269.8	130.7	136.0	-5.0	93.0	331.4	326.0
2	139.6	168.9	354.9	268.3	139.5	142.8	-4.6	90.2	321.7	317.4
3	145.9	172.3	340.6	257.6	145.7	148.3	-7.0	87.8	300.9	298.4
4	145.7	173.6	323.1	236.7	145.6	145.5	-6.7	94.6	281.8	281.4
5	144.3	174.5	309.5	221.1	144.2	143.1	-6.1	99.8	267.8	268.5
6	142.4	176.9	298.9	209.1	142.3	142.1	-5.8	105.4	257.1	258.7
7	146.7	177.2	290.8	190.6	146.5	136.9	-6.0	112.6	245.1	245.2
8	152.0	176.2	260.9	145.6	151.8	121.1	-6.6	127.9	205.5	208.7
9	148.9	208.1	241.1	158.3	148.7	151.1	-6.7	143.1	183.1	190.1
10	176.7	187.9	300.3	201.5	142.8	174.1	*****	70.7	160.2	172.1
11	146.2	191.2	208.4	55.9	146.2	52.0	.1	184.0	148.5	163.5

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.389	.468	1.074	.767	.389	.387	1.040	1.353
2	.416	.483	1.059	.767	.416	.408	1.024	1.370
3	.437	.495	1.020	.740	.436	.426	1.018	1.378
4	.436	.499	.968	.681	.436	.418	1.000	1.358
5	.432	.502	.927	.636	.432	.411	.992	1.310
6	.426	.509	.895	.601	.426	.409	.999	1.287
7	.440	.510	.871	.548	.439	.394	.934	1.259
8	.456	.507	.783	.419	.456	.349	.797	1.154
9	.446	.605	.723	.460	.446	.439	1.016	1.086
10	.533	.542	.907	.581	.431	.502	1.219	1.773
11	.438	.551	.624	.161	.438	.150	.356	.905

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	5.4	2.9	6.4	.354	.760	.154	.137	.029	.026
2	10.00	5.9	3.1	4.9	.341	.816	.114	.097	.022	.019
3	20.00	6.2	3.3	3.0	.339	.873	.080	.065	.016	.013
4	30.00	6.0	2.9	4.6	.368	.850	.102	.093	.020	.018
5	36.00	5.2	2.0	6.3	.391	.816	.133	.129	.027	.026
6	42.00	4.7	1.4	8.6	.411	.796	.156	.154	.031	.031
7	50.00	5.0	1.6	10.7	.460	.809	.153	.152	.031	.031
8	70.00	5.5	1.9	16.3	.566	.916	.078	.078	.016	.016
9	80.00	6.0	2.0	11.9	.479	.917	.089	.089	.018	.018
10	90.00	19.5	14.6	39.1	.438	.961	.030	-.038	.005	-.006
11	95.00	5.7	.1	-4.7	.894	.898	.148	.148	.024	.024

TABLE VI. - BLADE-ELEMENT DATA AT BLADE EDGES

FOR FIRST-STAGE STATOR

(a) 100 Percent of design speed; reading 821

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	40.4	-5.2	40.4	-5.2	347.1	1.000	16.06	.984
2	23.111	23.132	40.2	-4.8	40.2	-4.8	345.3	1.000	16.21	.981
3	21.872	21.938	38.9	-3.4	38.9	-3.4	341.3	1.000	16.35	.985
4	20.645	20.759	37.4	-4.7	37.4	-4.7	338.6	1.000	16.13	.985
5	19.931	20.074	37.4	-6.3	37.4	-6.3	337.3	1.000	15.88	.983
6	19.240	19.421	38.9	-8.0	38.9	-8.0	336.6	1.000	15.71	.983
7	18.478	18.699	40.9	-7.1	40.9	-7.1	336.3	1.000	15.80	.985
8	16.167	16.553	44.9	-4.5	44.9	-4.5	332.7	1.000	16.27	.987
9	14.915	15.410	47.8	-5.1	47.8	-5.1	331.8	1.000	16.05	.988
10	13.647	14.272	52.8	-2.8	52.8	-2.8	333.3	1.000	16.08	.970
11	13.010	13.706	55.3	-5.9	55.3	-5.9	333.8	1.000	15.99	.947

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	219.9	172.3	219.9	172.3	167.5	171.6	142.4	-15.7	.0	.0
2	221.7	175.1	221.7	175.1	169.2	174.4	143.2	-14.7	.0	.0
3	227.6	179.0	227.6	179.0	177.2	178.7	142.8	-10.6	.0	.0
4	234.4	173.5	234.4	173.5	186.3	172.9	142.2	-14.2	.0	.0
5	236.5	165.5	236.5	165.5	187.9	164.5	143.5	-18.1	.0	.0
6	233.7	161.1	233.7	161.1	181.8	159.5	146.7	-22.5	.0	.0
7	231.2	164.4	231.2	164.4	174.7	163.2	151.5	-20.3	.0	.0
8	231.6	174.7	231.6	174.7	164.0	174.1	163.5	-13.8	.0	.0
9	235.4	173.0	235.4	173.0	158.2	172.3	174.4	-15.3	.0	.0
10	247.8	162.6	247.8	162.6	149.8	162.4	197.4	-7.9	.0	.0
11	253.6	146.6	253.6	146.6	144.3	145.8	208.5	-14.9	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.610	.472	.610	.472	.465	.470	1.024	1.081
2	.617	.481	.617	.481	.471	.479	1.031	1.074
3	.639	.495	.639	.495	.498	.494	1.008	1.056
4	.663	.481	.663	.481	.527	.480	.928	1.038
5	.671	.459	.671	.459	.533	.456	.876	1.034
6	.663	.447	.663	.447	.516	.442	.877	1.039
7	.655	.457	.655	.457	.495	.453	.934	1.052
8	.660	.489	.660	.489	.468	.488	1.061	1.081
9	.673	.485	.673	.485	.452	.483	1.089	1.123
10	.710	.453	.710	.453	.429	.453	1.084	1.251
11	.728	.407	.728	.407	.414	.405	1.010	1.315

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.8	.8	9.3	.492	.000	.072	.072	.027	.027
2	10.00	6.7	.7	7.7	.476	.000	.085	.085	.032	.032
3	20.00	5.1	-.8	7.4	.451	.000	.064	.064	.023	.023
4	30.00	3.1	-2.7	5.4	.482	.000	.059	.059	.019	.019
5	36.00	2.5	-3.3	3.5	.520	.000	.064	.064	.020	.020
6	42.00	3.2	-2.5	1.6	.535	.000	.065	.065	.020	.020
7	50.00	4.3	-1.4	2.4	.510	.000	.059	.059	.018	.018
8	70.00	4.9	-.6	5.3	.445	.000	.053	.053	.014	.014
9	80.00	5.4	.1	5.4	.459	.000	.048	.048	.012	.012
10	90.00	7.4	2.3	9.5	.526	.000	.106	.106	.024	.024
11	95.00	8.4	3.3	7.9	.606	.000	.179	.179	.038	.038

TABLE VI. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE STATOR

(b) 100 Percent of design speed; reading 872

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	39.6	-.5	39.6	-.5	346.0	1.000	15.98	.983
2	23.111	23.132	38.4	-.5	38.4	-.5	343.6	1.000	16.23	.978
3	21.872	21.938	36.9	-.1	36.9	-.1	339.5	1.000	16.27	.987
4	20.645	20.759	36.2	-1.4	36.2	-1.4	337.8	1.000	16.06	.985
5	19.931	20.074	36.6	-2.4	36.6	-2.4	337.0	1.000	15.79	.983
6	19.240	19.421	38.5	-4.2	38.5	-4.2	336.2	1.000	15.57	.983
7	18.478	18.699	40.4	-3.8	40.4	-3.8	335.7	1.000	15.65	.985
8	16.167	16.553	44.2	-1.6	44.2	-1.6	333.0	1.000	16.37	.986
9	14.915	15.410	46.7	-2.4	46.7	-2.4	331.9	1.000	16.14	.986
10	13.647	14.272	51.6	-.9	51.6	-.9	333.1	1.000	16.08	.972
11	13.010	13.706	54.8	-3.1	54.8	-3.1	333.8	1.000	15.94	.954

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	224.6	176.2	224.6	176.2	173.1	176.2	143.1	-1.5	.0	.0
2	227.9	181.2	227.9	181.2	178.7	181.2	141.5	-1.5	.0	.0
3	233.4	185.5	233.4	185.5	186.5	185.5	140.2	-.2	.0	.0
4	240.4	179.0	240.4	179.0	194.0	178.9	142.0	-4.3	.0	.0
5	242.7	170.5	242.7	170.5	194.9	170.4	144.6	-7.3	.0	.0
6	238.5	165.0	238.5	165.0	186.7	164.6	148.4	-11.9	.0	.0
7	235.0	168.0	235.0	168.0	178.8	167.6	152.5	-11.1	.0	.0
8	238.7	180.9	238.7	180.9	171.1	180.9	166.4	-5.2	.0	.0
9	242.6	179.5	242.6	179.5	166.3	179.4	176.6	-7.5	.0	.0
10	252.0	169.5	252.0	169.5	156.6	169.5	197.5	-2.7	.0	.0
11	257.0	156.5	257.0	156.5	148.3	156.3	209.9	-8.5	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.625	.484	.625	.484	.482	.484	1.018	1.094
2	.638	.500	.638	.500	.500	.500	1.014	1.073
3	.659	.515	.659	.515	.527	.515	.994	1.050
4	.682	.498	.682	.498	.551	.498	.922	1.045
5	.690	.474	.690	.474	.554	.473	.874	1.049
6	.678	.458	.678	.458	.531	.457	.882	1.057
7	.668	.467	.668	.467	.508	.466	.937	1.066
8	.682	.507	.682	.507	.489	.507	1.057	1.106
9	.696	.504	.696	.504	.477	.503	1.078	1.139
10	.724	.474	.724	.474	.450	.474	1.083	1.250
11	.739	.435	.739	.435	.426	.435	1.054	1.325

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.2	.2	14.2	.462	.000	.074	.074	.028	.028
2	10.00	5.0	-.9	12.2	.439	.000	.092	.092	.034	.034
3	20.00	3.4	-2.5	10.9	.418	.000	.053	.053	.019	.019
4	30.00	2.1	-3.7	8.8	.458	.000	.057	.057	.019	.019
5	36.00	1.9	-3.9	7.5	.498	.000	.064	.064	.021	.021
6	42.00	3.0	-2.8	5.6	.517	.000	.063	.063	.020	.020
7	50.00	4.0	-1.7	5.9	.493	.000	.058	.058	.017	.017
8	70.00	4.4	-1.1	8.4	.429	.000	.054	.054	.014	.014
9	80.00	4.5	-.8	8.2	.442	.000	.050	.050	.012	.012
10	90.00	6.4	1.3	11.5	.501	.000	.095	.095	.021	.021
11	95.00	8.0	3.0	10.8	.569	.000	.150	.150	.032	.032

TABLE VI. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE STATOR

(c) 100 Percent of design speed; reading 810

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	34.4	-5.4	34.4	-5.4	340.9	1.000	15.36	.985
2	23.111	23.132	33.0	-5.8	33.0	-5.8	337.4	1.000	15.58	.986
3	21.872	21.938	31.8	-5.6	31.8	-5.6	334.1	1.000	15.69	.991
4	20.645	20.759	32.4	-5.4	32.4	-5.4	333.7	1.000	15.37	.987
5	19.931	20.074	33.6	-6.1	33.6	-6.1	333.3	1.000	15.07	.983
6	19.240	19.421	35.6	-7.6	35.6	-7.6	332.5	1.000	14.86	.983
7	18.478	18.699	37.4	-7.7	37.4	-7.7	332.2	1.000	15.04	.979
8	16.167	16.553	41.6	-4.2	41.6	-4.2	331.4	1.000	16.08	.986
9	14.915	15.410	44.8	-5.1	44.8	-5.1	331.2	1.000	15.96	.987
10	13.647	14.272	49.6	-4.7	49.6	-4.7	332.1	1.000	15.81	.980
11	13.010	13.706	51.8	-6.5	51.8	-6.5	332.8	1.000	15.83	.951

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	224.0	184.6	224.0	184.6	184.7	183.8	126.7	-17.5	.0	.0
2	225.2	191.1	225.2	191.1	188.9	190.1	122.6	-19.2	.0	.0
3	230.2	195.2	230.2	195.2	195.7	194.2	121.3	-19.1	.0	.0
4	236.3	186.0	236.3	186.0	199.5	185.2	126.7	-17.4	.0	.0
5	236.9	176.3	236.9	176.3	197.3	175.3	131.2	-18.7	.0	.0
6	232.0	170.5	232.0	170.5	188.7	169.0	134.9	-22.5	.0	.0
7	230.6	174.3	230.6	174.3	183.1	172.7	140.1	-23.4	.0	.0
8	239.8	194.8	239.8	194.8	179.4	194.2	159.2	-14.4	.0	.0
9	244.6	198.3	244.6	198.3	173.6	197.5	172.4	-17.5	.0	.0
10	253.6	191.6	253.6	191.6	164.4	191.0	193.1	-15.6	.0	.0
11	260.8	181.2	260.8	181.2	161.2	180.1	205.1	-20.5	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.629	.512	.629	.512	.518	.509	.995	.982
2	.636	.533	.636	.533	.533	.531	1.006	.945
3	.655	.549	.655	.549	.556	.546	.993	.919
4	.674	.522	.674	.522	.569	.519	.928	.937
5	.676	.493	.676	.493	.563	.491	.889	.950
6	.662	.477	.662	.477	.538	.473	.895	.957
7	.658	.488	.658	.488	.522	.484	.943	.973
8	.688	.550	.688	.550	.514	.548	1.083	1.043
9	.703	.560	.703	.560	.499	.558	1.138	1.096
10	.730	.540	.730	.540	.474	.538	1.161	1.201
11	.752	.508	.752	.508	.465	.505	1.117	1.263

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	.7	-5.3	8.9	.422	.000	.064	.064	.024	.024
2	10.00	-.8	-6.7	6.6	.386	.000	.058	.058	.022	.022
3	20.00	-2.2	-8.1	4.9	.368	.000	.038	.038	.013	.013
4	30.00	-2.0	-7.9	4.5	.416	.000	.049	.049	.016	.016
5	36.00	-1.5	-7.3	3.5	.459	.000	.063	.063	.020	.020
6	42.00	-.3	-6.1	1.8	.476	.000	.068	.068	.021	.021
7	50.00	.6	-5.1	1.5	.455	.000	.084	.084	.025	.025
8	70.00	1.3	-4.1	5.3	.377	.000	.050	.050	.013	.013
9	80.00	2.2	-3.2	5.2	.376	.000	.045	.045	.011	.011
10	90.00	4.0	-1.1	7.4	.425	.000	.068	.068	.015	.015
11	95.00	4.7	-.4	7.0	.486	.000	.156	.156	.033	.033

TABLE VI. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE STATOR

(d) 100 Percent of design speed; reading 833

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	33.2	-5.8	33.2	-5.8	339.2	1.000	15.24	.983
2	23.111	23.132	31.9	-6.2	31.9	-6.2	336.5	1.000	15.44	.986
3	21.872	21.938	30.8	-6.5	30.8	-6.5	332.9	1.000	15.54	.989
4	20.645	20.759	31.7	-5.8	31.7	-5.8	332.7	1.000	15.16	.987
5	19.931	20.074	32.8	-6.6	32.8	-6.6	332.1	1.000	14.85	.983
6	19.240	19.421	34.7	-8.0	34.7	-8.0	331.6	1.000	14.68	.981
7	18.478	18.699	36.9	-8.1	36.9	-8.1	331.7	1.000	14.85	.977
8	16.167	16.553	41.3	-4.3	41.3	-4.3	331.4	1.000	16.06	.985
9	14.915	15.410	44.2	-5.0	44.2	-5.0	331.4	1.000	16.01	.984
10	13.647	14.272	48.7	-4.7	48.7	-4.7	332.0	1.000	15.80	.979
11	13.010	13.706	51.1	-6.3	51.1	-6.3	332.4	1.000	15.71	.951

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	226.3	188.7	226.3	188.7	189.3	187.8	124.0	-19.0	.0	.0
2	226.9	195.2	226.9	195.2	192.6	194.1	119.9	-21.2	.0	.0
3	231.1	198.8	231.1	198.8	198.5	197.5	118.2	-22.4	.0	.0
4	236.4	188.5	236.4	188.5	201.1	187.5	124.2	-19.2	.0	.0
5	236.5	178.5	236.5	178.5	198.7	177.3	128.1	-20.6	.0	.0
6	232.2	172.8	232.2	172.8	190.8	171.1	132.4	-24.1	.0	.0
7	230.8	177.0	230.8	177.0	184.7	175.2	138.4	-25.0	.0	.0
8	242.4	199.5	242.4	199.5	182.1	198.9	160.0	-15.0	.0	.0
9	248.6	204.7	248.6	204.7	178.2	203.9	173.2	-17.9	.0	.0
10	255.9	197.4	255.9	197.4	168.8	196.7	192.4	-16.2	.0	.0
11	260.7	183.5	260.7	183.5	163.8	182.4	202.9	-20.3	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.637	.525	.637	.525	.533	.522	.992	.975
2	.642	.547	.642	.547	.545	.543	1.008	.936
3	.659	.560	.659	.560	.566	.557	.995	.908
4	.675	.530	.675	.530	.575	.527	.932	.927
5	.676	.501	.676	.501	.568	.497	.892	.938
6	.664	.484	.664	.484	.545	.480	.897	.947
7	.659	.497	.659	.497	.527	.492	.949	.969
8	.696	.564	.696	.564	.523	.562	1.093	1.055
9	.715	.580	.715	.580	.513	.577	1.144	1.105
10	.738	.557	.738	.557	.487	.555	1.165	1.197
11	.753	.515	.753	.515	.473	.512	1.114	1.251

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-.3	-6.3	8.8	.408	.000	.069	.069	.026	.026
2	10.00	-1.6	-7.5	6.4	.371	.000	.057	.057	.021	.021
3	20.00	-2.9	-8.8	4.4	.354	.000	.042	.042	.015	.015
4	30.00	-2.5	-8.4	4.3	.405	.000	.048	.048	.016	.016
5	36.00	-2.0	-7.8	3.2	.448	.000	.063	.063	.020	.020
6	42.00	-.9	-6.6	1.7	.465	.000	.075	.075	.023	.023
7	50.00	.3	-5.4	1.4	.444	.000	.090	.090	.027	.027
8	70.00	1.3	-4.2	5.5	.365	.000	.055	.055	.014	.014
9	80.00	1.8	-3.5	5.4	.361	.000	.056	.056	.014	.014
10	90.00	3.4	-1.8	7.5	.408	.000	.068	.068	.015	.015
11	95.00	4.1	-.9	7.4	.475	.000	.156	.156	.033	.033

TABLE VI. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE STATOR

(e) 80 Percent of design speed; reading 846

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	42.9	-9.7	42.9	-9.7	329.3	1.000	14.02	.978
2	23.111	23.132	44.6	-9.5	44.6	-9.5	327.8	1.000	13.99	.981
3	21.872	21.938	42.7	-6.6	42.7	-6.6	324.4	1.000	13.97	.985
4	20.645	20.759	39.9	-5.7	39.9	-5.7	321.8	1.000	13.99	.986
5	19.931	20.074	40.3	-5.4	40.3	-5.4	321.5	1.000	13.97	.987
6	19.240	19.421	42.2	-6.0	42.2	-6.0	321.2	1.000	13.93	.986
7	18.478	18.699	44.4	-5.8	44.4	-5.8	320.5	1.000	13.91	.988
8	16.167	16.553	47.3	-6.7	47.3	-6.7	317.6	1.000	13.88	.991
9	14.915	15.410	48.8	-5.2	48.8	-5.2	317.1	1.000	13.91	.987
10	13.647	14.272	53.9	-2.8	53.9	-2.8	318.0	1.000	13.97	.974
11	13.010	13.706	58.2	-8.1	58.2	-8.1	318.3	1.000	13.86	.963

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	168.4	129.6	168.4	129.6	123.4	127.8	114.6	-21.7	.0	.0
2	166.6	129.3	166.6	129.3	118.7	127.5	116.9	-21.3	.0	.0
3	167.7	130.1	167.7	130.1	123.2	129.3	113.8	-15.0	.0	.0
4	175.4	131.6	175.4	131.6	134.6	130.9	112.5	-13.0	.0	.0
5	180.7	131.0	180.7	131.0	137.8	130.5	116.8	-12.3	.0	.0
6	181.1	130.0	181.1	130.0	134.1	129.3	121.8	-13.5	.0	.0
7	177.7	129.7	177.7	129.7	126.9	129.1	124.4	-13.2	.0	.0
8	177.1	130.3	177.1	130.3	120.0	129.4	130.2	-15.1	.0	.0
9	184.5	129.8	184.5	129.8	121.5	129.3	138.9	-11.7	.0	.0
10	195.0	122.1	195.0	122.1	115.0	122.0	157.5	-5.9	.0	.0
11	198.4	108.7	198.4	108.7	104.5	107.6	168.7	-15.4	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.473	.361	.473	.361	.347	.356	1.036	.878
2	.469	.361	.469	.361	.334	.356	1.074	.885
3	.475	.365	.475	.365	.349	.363	1.049	.846
4	.500	.371	.500	.371	.384	.369	.972	.824
5	.516	.370	.516	.370	.394	.368	.947	.844
6	.518	.367	.518	.367	.383	.365	.964	.868
7	.508	.366	.508	.366	.363	.364	1.017	.873
8	.508	.370	.508	.370	.345	.367	1.078	.872
9	.531	.369	.531	.369	.350	.367	1.064	.902
10	.563	.346	.563	.346	.332	.345	1.060	1.008
11	.573	.307	.573	.307	.302	.304	1.030	1.090

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	9.2	3.3	4.8	.540	.000	.153	.153	.058	.058
2	10.00	10.9	5.0	2.9	.533	.000	.138	.138	.051	.051
3	20.00	8.9	3.0	4.1	.495	.000	.105	.105	.037	.037
4	30.00	5.5	-.3	4.3	.488	.000	.089	.089	.030	.030
5	36.00	5.3	-.5	4.3	.505	.000	.081	.081	.026	.026
6	42.00	6.5	.7	3.5	.514	.000	.081	.081	.025	.025
7	50.00	7.7	2.0	3.5	.501	.000	.077	.077	.023	.023
8	70.00	7.2	1.7	3.0	.478	.000	.053	.053	.014	.014
9	80.00	6.3	1.0	5.1	.493	.000	.077	.077	.019	.019
10	90.00	8.4	3.2	9.4	.558	.000	.136	.136	.030	.030
11	95.00	11.1	6.1	5.5	.646	.000	.185	.185	.039	.039

TABLE VI. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE STATOR

(f) 80 Percent of design speed; reading 799

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	38.3	-7.3	38.3	-7.3	326.3	1.000	13.89	.989
2	23.111	23.132	38.4	-7.8	38.4	-7.8	324.5	1.000	13.91	.990
3	21.872	21.938	35.2	-8.3	35.2	-8.3	320.6	1.000	14.00	.992
4	20.645	20.759	34.7	-7.6	34.7	-7.6	319.5	1.000	13.90	.992
5	19.931	20.074	36.2	-6.9	36.2	-6.9	319.6	1.000	13.82	.992
6	19.240	19.421	38.7	-6.6	38.7	-6.6	319.8	1.000	13.79	.991
7	18.478	18.699	41.2	-6.2	41.2	-6.2	319.5	1.000	13.77	.992
8	16.167	16.553	44.6	-7.2	44.6	-7.2	317.0	1.000	13.83	.992
9	14.915	15.410	46.9	-6.1	46.9	-6.1	317.0	1.000	13.82	.992
10	13.647	14.272	52.0	-3.7	52.0	-3.7	317.9	1.000	13.89	.983
11	13.010	13.706	54.0	-7.5	54.0	-7.5	318.2	1.000	13.85	.961

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	177.9	144.8	177.9	144.8	139.6	143.6	110.4	-18.4	.0	.0
2	177.1	146.1	177.1	146.1	138.8	144.7	110.0	-19.9	.0	.0
3	179.0	149.3	179.0	149.3	146.2	147.7	103.2	-21.7	.0	.0
4	185.9	147.0	185.9	147.0	152.8	145.7	105.8	-19.4	.0	.0
5	189.3	143.9	189.3	143.9	152.8	142.9	111.8	-17.4	.0	.0
6	189.2	142.1	189.2	142.1	147.6	141.2	118.3	-16.4	.0	.0
7	185.0	142.0	185.0	142.0	139.2	141.1	121.8	-15.4	.0	.0
8	182.5	143.8	182.5	143.8	129.9	142.6	128.2	-18.1	.0	.0
9	188.1	146.0	188.1	146.0	128.4	145.1	137.5	-15.6	.0	.0
10	200.5	140.2	200.5	140.2	123.5	139.9	158.0	-9.0	.0	.0
11	205.2	124.1	205.2	124.1	120.8	123.0	165.9	-16.1	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.504	.406	.504	.406	.395	.403	1.029	.847
2	.503	.411	.503	.411	.394	.407	1.042	.833
3	.511	.423	.511	.423	.418	.419	1.010	.772
4	.533	.417	.533	.417	.439	.414	.953	.776
5	.544	.408	.544	.408	.439	.405	.935	.806
6	.543	.403	.543	.403	.424	.400	.956	.837
7	.531	.403	.531	.403	.399	.400	1.014	.846
8	.525	.410	.525	.410	.374	.406	1.098	.844
9	.542	.416	.542	.416	.370	.414	1.130	.877
10	.580	.398	.580	.398	.357	.398	1.132	.991
11	.594	.351	.594	.351	.349	.348	1.019	1.031

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.2	-1.8	6.6	.463	.000	.069	.069	.026	.026
2	10.00	4.3	-1.7	4.1	.449	.000	.065	.065	.024	.024
3	20.00	.9	-5.0	1.8	.412	.000	.048	.048	.017	.017
4	30.00	-.1	-6.0	1.9	.434	.000	.043	.043	.014	.014
5	36.00	.7	-5.0	2.2	.460	.000	.042	.042	.014	.014
6	42.00	2.5	-3.3	2.4	.470	.000	.050	.050	.015	.015
7	50.00	4.0	-1.7	2.7	.454	.000	.048	.048	.014	.014
8	70.00	4.0	-1.5	2.0	.421	.000	.046	.046	.012	.012
9	80.00	3.9	-1.4	3.7	.420	.000	.042	.042	.010	.010
10	90.00	6.0	.8	7.9	.484	.000	.082	.082	.018	.018
11	95.00	6.4	1.3	5.6	.581	.000	.183	.183	.039	.039

TABLE VI. - Concluded. BLADE-ELEMENT DATA AT

BLADE EDGES FOR FIRST-STAGE STATOR

(g) 80 Percent of design speed; reading 858

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.711	23.708	31.8	-8.2	31.8	-8.2	321.4	1.000	13.30	.991
2	23.111	23.132	30.3	-8.4	30.3	-8.4	319.1	1.000	13.45	.992
3	21.872	21.938	28.6	-8.7	28.6	-8.7	316.4	1.000	13.51	.994
4	20.645	20.759	29.6	-7.3	29.6	-7.3	316.1	1.000	13.44	.995
5	19.931	20.074	30.8	-7.2	30.8	-7.2	316.2	1.000	13.31	.994
6	19.240	19.421	32.9	-7.6	32.9	-7.6	316.3	1.000	13.26	.992
7	18.478	18.699	35.1	-6.7	35.1	-6.7	316.5	1.000	13.34	.991
8	16.167	16.553	43.8	-6.3	43.8	-6.3	315.6	1.000	13.67	.993
9	14.915	15.410	41.1	-6.5	41.1	-6.5	316.0	1.000	13.73	.990
10	13.647	14.272	20.7	-5.6	20.7	-5.6	317.2	1.000	13.83	.987
11	13.010	13.706	73.6	-11.9	73.6	-11.9	317.7	1.000	13.85	.964

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	180.8	148.5	180.8	148.5	153.7	147.0	95.2	-21.1	.0	.0
2	182.8	155.2	182.8	155.2	157.9	153.5	92.1	-22.6	.0	.0
3	186.7	160.6	186.7	160.6	164.0	158.8	89.3	-24.2	.0	.0
4	193.8	157.9	193.8	157.9	168.4	156.6	95.9	-20.1	.0	.0
5	196.5	153.8	196.5	153.8	168.7	152.6	100.7	-19.3	.0	.0
6	194.8	151.5	194.8	151.5	163.6	150.2	105.7	-20.0	.0	.0
7	192.9	154.1	192.9	154.1	157.7	153.0	111.0	-18.1	.0	.0
8	177.6	165.2	177.6	165.2	128.2	164.2	122.9	-18.2	.0	.0
9	206.9	171.2	206.9	171.2	155.8	170.1	136.1	-19.5	.0	.0
10	188.0	171.6	188.0	171.6	175.8	170.8	66.5	-16.8	.0	.0
11	179.4	162.3	179.4	162.3	50.6	158.8	172.1	-33.4	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.516	.421	.516	.421	.439	.416	.956	.762
2	.524	.442	.524	.442	.453	.437	.972	.732
3	.539	.460	.539	.460	.473	.455	.968	.698
4	.561	.452	.561	.452	.487	.448	.930	.726
5	.569	.440	.569	.440	.488	.436	.904	.746
6	.563	.433	.563	.433	.473	.429	.918	.765
7	.557	.440	.557	.440	.456	.437	.970	.784
8	.511	.474	.511	.474	.369	.471	1.281	.817
9	.601	.492	.601	.492	.453	.489	1.092	.864
10	.542	.492	.542	.492	.507	.490	.972	.542
11	.515	.464	.515	.464	.145	.454	3.137	1.286

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-1.9	-7.9	6.3	.425	.000	.057	.057	.022	.022
2	10.00	-3.4	-9.3	4.1	.385	.000	.050	.050	.018	.018
3	20.00	-5.2	-11.1	2.0	.354	.000	.032	.032	.011	.011
4	30.00	-4.7	-10.5	2.7	.385	.000	.028	.028	.009	.009
5	36.00	-4.1	-9.9	2.5	.414	.000	.029	.029	.009	.009
6	42.00	-2.9	-8.7	1.9	.423	.000	.041	.041	.013	.013
7	50.00	-1.6	-7.2	2.6	.401	.000	.047	.047	.014	.014
8	70.00	3.7	-1.8	3.4	.277	.000	.045	.045	.012	.012
9	80.00	-1.4	-6.7	3.8	.354	.000	.044	.044	.011	.011
10	90.00	-24.8	-29.9	6.5	.185	.000	.072	.072	.016	.016
11	95.00	26.5	21.5	1.7	.336	.000	.219	.219	.046	.046

TABLE VII. - BLADE-ELEMENT DATA AT BLADE EDGES

FOR SECOND-STAGE ROTOR

(a) 100 Percent of design speed; reading 821

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-4.9	39.9	65.3	57.9	347.1	1.163	15.80	1.557
2	22.949	22.659	-4.4	41.2	64.1	57.0	345.3	1.164	15.89	1.557
3	21.849	21.653	-3.0	43.6	61.9	54.8	341.3	1.163	16.10	1.537
4	20.770	20.663	-4.2	42.1	61.7	52.7	338.6	1.155	15.89	1.550
5	20.142	20.096	-5.6	40.5	62.5	51.1	337.3	1.152	15.62	1.579
6	19.545	19.553	-7.2	39.2	63.0	49.5	336.6	1.149	15.44	1.596
7	18.885	18.959	-6.3	39.4	61.6	46.9	336.3	1.145	15.57	1.593
8	16.891	17.226	-4.1	43.0	57.5	40.4	332.7	1.140	16.05	1.523
9	15.804	16.330	-4.7	46.6	57.2	35.2	331.8	1.144	15.85	1.526
10	14.676	15.458	-2.8	50.5	57.8	24.6	333.3	1.148	15.60	1.574
11	14.084	15.032	-6.2	50.2	61.7	22.7	333.8	1.148	15.14	1.595

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	187.7	206.1	446.7	297.3	187.0	158.0	-15.9	132.3	389.8	384.1
2	193.5	207.5	441.3	286.7	193.0	156.0	-14.8	136.8	382.1	377.3
3	200.6	210.4	424.7	264.1	200.3	152.4	-10.6	145.0	363.9	360.7
4	194.3	208.9	408.8	256.0	193.8	154.9	-14.2	140.2	345.7	343.9
5	184.5	210.0	398.1	254.4	183.6	159.7	-18.1	136.4	335.2	334.4
6	178.6	211.2	389.8	251.9	177.2	163.6	-22.3	133.5	324.9	325.0
7	181.8	215.4	379.4	243.8	180.7	166.5	-20.1	136.7	313.6	314.8
8	188.2	220.2	349.9	211.4	187.8	161.0	-13.6	150.3	281.7	287.3
9	180.2	225.0	331.5	189.3	179.6	154.7	-14.9	163.4	263.7	272.5
10	158.6	241.9	297.4	169.1	158.4	153.7	-7.7	186.8	244.1	257.1
11	134.9	241.3	282.6	167.5	134.1	154.5	-14.5	185.4	234.2	250.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.516	.526	1.228	.759	.514	.403	.845	1.524
2	.534	.531	1.218	.734	.533	.399	.809	1.499
3	.558	.542	1.182	.681	.558	.393	.761	1.457
4	.542	.543	1.141	.665	.541	.402	.800	1.489
5	.514	.548	1.110	.663	.512	.416	.870	1.538
6	.498	.552	1.086	.659	.494	.428	.923	1.577
7	.507	.565	1.059	.640	.504	.437	.921	1.559
8	.529	.584	.984	.560	.528	.426	.857	1.512
9	.506	.597	.931	.502	.504	.410	.862	1.480
10	.442	.642	.829	.449	.441	.408	.970	1.379
11	.374	.640	.782	.444	.371	.410	1.152	1.418

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.6	1.1	3.4	.459	.826	.135	.075	.027	.015
2	10.00	3.3	.7	3.3	.477	.819	.143	.089	.029	.018
3	20.00	2.7	-.0	3.4	.507	.801	.162	.120	.033	.024
4	30.00	4.3	1.2	4.2	.500	.856	.119	.077	.024	.016
5	36.00	6.2	2.8	4.6	.488	.916	.071	.024	.015	.005
6	42.00	7.6	3.8	5.1	.481	.957	.038	-.013	.008	-.003
7	50.00	7.2	3.1	5.3	.484	.975	.022	-.022	.005	-.005
8	70.00	5.9	.8	9.1	.526	.912	.082	.055	.017	.012
9	80.00	6.4	.9	11.5	.571	.887	.117	.099	.025	.021
10	90.00	6.5	1.1	11.1	.594	.931	.088	.085	.019	.019
11	95.00	9.3	4.0	15.6	.577	.964	.050	.047	.011	.010

TABLE VII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE ROTOR

(b) 100 Percent of design speed; reading 872

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-.5	44.0	64.1	56.7	346.0	1.170	15.70	1.569
2	22.949	22.659	-.4	45.1	62.5	55.4	343.6	1.172	15.87	1.562
3	21.849	21.653	-.1	45.5	60.4	52.6	339.5	1.169	16.05	1.545
4	20.770	20.663	-1.2	43.4	60.3	50.2	337.8	1.160	15.81	1.568
5	20.142	20.096	-2.2	42.3	61.1	48.7	337.0	1.156	15.52	1.594
6	19.545	19.553	-3.7	40.9	61.7	46.8	336.2	1.154	15.31	1.619
7	18.885	18.959	-3.4	40.5	60.4	44.0	335.7	1.151	15.41	1.619
8	16.891	17.226	-1.5	42.7	55.9	36.1	333.0	1.143	16.13	1.546
9	15.804	16.330	-2.3	45.9	55.5	31.5	331.9	1.146	15.92	1.537
10	14.676	15.458	-.9	49.5	56.4	21.6	333.1	1.151	15.63	1.570
11	14.084	15.032	-3.3	48.1	59.6	18.4	333.8	1.151	15.21	1.613

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	192.4	217.5	440.6	284.8	192.4	156.4	-1.6	151.1	394.9	389.1
2	201.1	219.7	436.0	273.2	201.1	155.1	-1.5	155.5	385.3	380.4
3	208.7	223.0	422.1	257.4	208.7	156.4	-.2	159.0	366.7	363.4
4	201.3	222.1	405.9	252.1	201.2	161.3	-4.3	152.7	348.2	346.4
5	190.8	223.2	394.9	249.9	190.6	165.1	-7.2	150.2	338.6	337.9
6	183.6	224.7	385.9	248.0	183.2	169.8	-11.9	147.2	327.8	327.9
7	186.3	229.9	376.9	242.8	186.0	174.7	-11.0	149.4	316.8	318.0
8	195.6	237.8	348.3	216.4	195.5	174.8	-5.1	161.2	283.2	288.8
9	187.3	239.2	330.6	195.3	187.1	166.4	-7.4	171.8	265.1	273.9
10	165.3	254.6	298.7	177.7	165.3	165.2	-2.7	193.7	246.1	259.2
11	143.7	261.1	283.5	183.8	143.4	174.5	-8.2	194.2	236.3	252.2

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.530	.556	1.215	.728	.530	.400	.813	1.474
2	.558	.563	1.209	.701	.558	.398	.772	1.439
3	.584	.577	1.181	.666	.584	.405	.749	1.405
4	.564	.579	1.136	.657	.563	.420	.802	1.437
5	.533	.583	1.103	.653	.533	.431	.866	1.486
6	.512	.589	1.077	.650	.511	.445	.927	1.528
7	.521	.605	1.054	.639	.520	.460	.939	1.519
8	.551	.632	.981	.575	.550	.465	.894	1.451
9	.527	.636	.930	.519	.527	.443	.889	1.426
10	.461	.678	.834	.473	.461	.440	1.000	1.347
11	.398	.696	.786	.490	.398	.465	1.216	1.369

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	2.4	-.1	2.2	.484	.809	.155	.106	.032	.022
2	10.00	1.7	-.8	1.7	.506	.788	.175	.133	.037	.028
3	20.00	1.2	-1.5	1.3	.523	.782	.182	.148	.039	.032
4	30.00	2.9	-.3	1.7	.509	.856	.122	.089	.026	.019
5	36.00	4.8	1.3	2.1	.497	.911	.078	.041	.017	.009
6	42.00	6.3	2.5	2.4	.488	.957	.038	-.002	.008	-.001
7	50.00	6.1	2.0	2.3	.487	.978	.020	-.016	.004	-.004
8	70.00	4.3	-.9	4.9	.512	.926	.070	.051	.016	.011
9	80.00	4.7	-.7	7.8	.552	.891	.114	.102	.025	.023
10	90.00	5.1	-.3	8.1	.568	.907	.120	.117	.027	.026
11	95.00	7.2	1.9	11.4	.523	.966	.048	.047	.011	.010

TABLE VII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE ROTOR

(c) 100 Percent of design speed; reading 810

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-5.0	34.6	63.7	57.2	340.9	1.153	15.13	1.526
2	22.949	22.659	-5.2	35.4	62.1	56.7	337.4	1.155	15.36	1.505
3	21.849	21.653	-5.0	36.0	60.1	54.7	334.1	1.152	15.54	1.501
4	20.770	20.663	-4.7	36.8	60.0	52.8	333.7	1.145	15.17	1.531
5	20.142	20.096	-5.4	37.3	60.9	51.8	333.3	1.143	14.82	1.558
6	19.545	19.553	-6.8	37.1	61.6	50.3	332.5	1.144	14.61	1.581
7	18.885	18.959	-6.9	37.1	60.4	47.7	332.2	1.143	14.72	1.583
8	16.891	17.226	-3.8	38.8	54.4	37.5	331.4	1.138	15.86	1.504
9	15.804	16.330	-4.7	40.2	53.5	32.9	331.2	1.138	15.76	1.508
10	14.676	15.458	-4.7	43.5	54.4	25.8	332.1	1.142	15.49	1.513
11	14.084	15.032	-6.9	43.0	57.2	23.1	332.8	1.142	15.06	1.549

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	202.2	208.7	455.3	317.0	201.4	171.7	-17.7	118.5	390.7	385.0
2	213.1	206.9	453.8	307.5	212.2	168.6	-19.3	119.9	381.8	377.0
3	221.0	208.5	441.8	291.9	220.1	168.7	-19.2	122.5	363.9	360.6
4	210.0	208.0	419.1	275.6	209.3	166.6	-17.4	124.5	345.8	344.0
5	197.6	207.2	405.0	266.4	196.7	164.9	-18.6	125.4	335.5	334.7
6	189.9	208.4	395.8	260.2	188.5	166.3	-22.4	125.6	325.6	325.8
7	193.6	213.8	388.9	253.3	192.2	170.6	-23.2	129.0	314.9	316.1
8	211.6	233.9	362.9	229.7	211.1	182.2	-14.1	146.7	281.0	286.6
9	207.6	238.2	348.0	216.8	206.9	182.0	-17.1	153.6	262.7	271.5
10	186.4	247.3	318.9	199.5	185.7	179.5	-15.2	170.1	244.1	257.1
11	165.4	251.9	303.0	200.3	164.2	184.2	-19.9	171.9	234.8	250.6

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.563	.541	1.269	.821	.561	.445	.853	1.509
2	.599	.538	1.276	.800	.597	.439	.795	1.484
3	.626	.546	1.252	.764	.624	.442	.766	1.458
4	.593	.547	1.184	.725	.591	.438	.796	1.467
5	.556	.545	1.141	.701	.554	.434	.838	1.506
6	.534	.549	1.113	.686	.530	.438	.882	1.547
7	.545	.565	1.096	.669	.542	.451	.887	1.541
8	.600	.624	1.030	.613	.599	.486	.863	1.438
9	.588	.637	.986	.579	.586	.486	.880	1.445
10	.524	.661	.897	.533	.522	.480	.967	1.388
11	.462	.673	.846	.535	.458	.492	1.122	1.404

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	2.1	-.4	2.7	.416	.839	.115	.052	.023	.011
2	10.00	1.3	-1.2	3.0	.435	.799	.143	.084	.029	.017
3	20.00	.9	-1.8	3.4	.452	.809	.137	.086	.028	.018
4	30.00	2.6	-.5	4.3	.456	.890	.083	.039	.017	.008
5	36.00	4.6	1.2	5.2	.458	.941	.047	.002	.009	.000
6	42.00	6.2	2.4	5.9	.461	.972	.023	-.026	.005	-.005
7	50.00	6.1	2.0	6.0	.469	.977	.019	-.026	.004	-.005
8	70.00	2.8	-2.3	6.2	.490	.896	.090	.068	.020	.015
9	80.00	2.7	-2.7	9.2	.506	.898	.094	.075	.021	.016
10	90.00	3.1	-2.4	12.3	.518	.885	.124	.117	.027	.026
11	95.00	4.8	-.5	16.1	.490	.937	.076	.071	.016	.015

TABLE VII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE ROTOR

(d) 100 Percent of design speed; reading 833

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-5.3	26.4	63.3	60.2	339.2	1.118	14.99	1.341
2	22.949	22.659	-5.6	26.4	61.7	58.4	336.5	1.122	15.22	1.345
3	21.849	21.653	-5.7	26.0	59.9	56.2	332.9	1.120	15.37	1.349
4	20.770	20.663	-5.2	26.7	59.8	54.6	332.7	1.113	14.97	1.388
5	20.142	20.096	-5.9	27.4	60.8	53.7	332.1	1.113	14.60	1.416
6	19.545	19.553	-7.1	28.0	61.3	52.3	331.6	1.116	14.40	1.439
7	18.885	18.959	-7.2	28.9	60.1	50.1	331.7	1.117	14.51	1.437
8	16.891	17.226	-3.9	33.7	53.8	38.5	331.4	1.125	15.81	1.378
9	15.804	16.330	-4.7	34.9	52.6	31.2	331.4	1.132	15.75	1.432
10	14.676	15.458	-4.7	37.3	53.6	22.0	332.0	1.141	15.47	1.496
11	14.084	15.032	-6.8	36.5	56.8	19.4	332.4	1.140	14.94	1.550

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	207.1	191.9	459.4	345.9	206.2	171.8	-19.2	85.4	391.3	385.6
2	218.3	198.1	457.9	339.0	217.3	177.4	-21.4	88.0	381.7	376.9
3	225.7	202.8	447.6	327.7	224.5	182.2	-22.5	89.0	364.7	361.4
4	213.1	201.4	422.3	310.9	212.2	179.9	-19.2	90.6	345.9	344.1
5	200.2	200.4	408.1	300.8	199.2	177.9	-20.5	92.3	335.6	334.9
6	192.6	201.9	398.4	291.8	191.2	178.3	-23.9	94.7	325.6	325.7
7	196.7	206.2	391.4	281.5	195.2	180.5	-24.7	99.7	314.5	315.7
8	217.2	235.9	367.2	250.8	216.7	196.2	-14.7	131.0	281.7	287.3
9	214.6	254.1	352.6	243.5	213.9	208.3	-17.5	145.4	262.8	271.6
10	191.9	276.9	322.6	237.5	191.2	220.1	-15.7	167.9	244.1	257.1
11	167.3	284.8	303.4	242.9	166.2	229.1	-19.7	169.3	234.2	249.9

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.580	.504	1.285	.909	.577	.451	.833	1.510
2	.616	.522	1.292	.894	.613	.468	.817	1.483
3	.642	.539	1.273	.871	.639	.485	.812	1.469
4	.604	.537	1.196	.829	.601	.480	.848	1.469
5	.565	.535	1.152	.803	.562	.475	.893	1.509
6	.543	.539	1.123	.779	.539	.476	.933	1.547
7	.555	.551	1.105	.752	.551	.482	.925	1.537
8	.618	.634	1.044	.674	.616	.527	.905	1.424
9	.610	.685	1.002	.656	.608	.561	.974	1.436
10	.540	.749	.909	.642	.539	.595	1.151	1.384
11	.468	.772	.848	.659	.465	.621	1.379	1.396

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	1.7	-.9	5.7	.333	.738	.145	.080	.027	.015
2	10.00	.9	-1.6	4.7	.348	.722	.158	.097	.031	.019
3	20.00	.7	-2.0	4.9	.355	.743	.148	.092	.029	.018
4	30.00	2.4	-.7	6.1	.351	.869	.077	.032	.015	.006
5	36.00	4.4	1.0	7.2	.353	.923	.048	.001	.009	.000
6	42.00	6.0	2.2	8.0	.362	.947	.035	-.015	.007	-.003
7	50.00	5.8	1.7	8.5	.378	.928	.049	.004	.010	.001
8	70.00	2.2	-2.9	7.3	.427	.767	.179	.157	.039	.034
9	80.00	1.8	-3.6	7.5	.431	.816	.159	.139	.035	.031
10	90.00	2.3	-3.1	8.5	.405	.865	.142	.134	.032	.030
11	95.00	4.4	-.9	12.4	.349	.949	.060	.055	.013	.012

TABLE VII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE ROTOR

(e) 80 Percent of design speed; reading 846

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-9.0	30.1	67.7	59.1	329.3	1.096	13.72	1.332
2	22.949	22.659	-8.8	32.4	67.1	58.3	327.8	1.099	13.72	1.336
3	21.849	21.653	-6.0	37.7	65.2	56.1	324.4	1.102	13.76	1.332
4	20.770	20.663	-5.2	39.2	63.7	53.9	321.8	1.100	13.80	1.335
5	20.142	20.096	-4.9	38.9	63.1	52.3	321.5	1.097	13.78	1.337
6	19.545	19.553	-5.4	38.3	62.7	50.7	321.2	1.095	13.74	1.342
7	18.885	18.959	-5.3	39.1	62.0	48.7	320.5	1.094	13.74	1.341
8	16.891	17.226	-6.1	41.8	60.3	41.4	317.6	1.095	13.76	1.334
9	15.804	16.330	-4.9	45.1	59.0	33.7	317.1	1.098	13.72	1.352
10	14.676	15.458	-2.7	48.6	59.6	23.7	318.0	1.101	13.61	1.370
11	14.084	15.032	-8.5	46.7	64.0	22.1	318.3	1.101	13.35	1.385

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	139.6	159.2	363.8	268.4	137.8	137.8	-21.9	79.7	314.7	310.1
2	140.8	159.4	357.1	256.2	139.2	134.5	-21.5	85.5	307.3	303.5
3	143.2	162.1	338.8	229.7	142.4	128.2	-15.1	99.2	292.4	289.8
4	145.2	164.1	326.4	215.8	144.6	127.1	-13.0	103.7	279.6	278.1
5	144.5	165.9	318.2	210.8	144.0	129.1	-12.2	104.2	271.5	270.9
6	143.0	166.6	310.9	206.4	142.4	130.7	-13.4	103.4	263.0	263.1
7	142.1	168.1	301.7	197.7	141.5	130.5	-13.0	105.9	253.4	254.4
8	139.0	175.5	279.0	174.2	138.2	130.8	-14.8	117.0	227.6	232.1
9	134.5	185.7	260.5	157.4	134.0	131.0	-11.5	131.6	211.9	218.9
10	119.4	199.7	235.4	144.2	119.3	132.0	-5.7	149.8	197.2	207.7
11	100.7	200.8	227.3	148.8	99.6	137.8	-14.9	146.1	189.4	202.1

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.389	.426	1.015	.718	.385	.369	1.000	1.467
2	.394	.427	.999	.686	.389	.360	.967	1.463
3	.403	.436	.954	.618	.401	.345	.901	1.395
4	.411	.444	.923	.584	.409	.344	.879	1.369
5	.409	.450	.900	.571	.407	.350	.896	1.355
6	.405	.452	.880	.560	.403	.355	.918	1.349
7	.402	.457	.854	.538	.401	.355	.922	1.328
8	.395	.480	.793	.477	.393	.358	.946	1.293
9	.382	.509	.740	.432	.381	.359	.977	1.223
10	.338	.548	.666	.396	.337	.363	1.107	1.148
11	.264	.551	.641	.409	.281	.378	1.384	1.215

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	6.1	3.6	4.6	.367	.892	.067	.042	.013	.008
2	10.00	6.2	3.7	4.6	.393	.872	.084	.061	.016	.012
3	20.00	6.0	3.3	4.7	.440	.837	.117	.105	.023	.021
4	30.00	6.3	3.2	5.4	.459	.858	.105	.098	.021	.019
5	36.00	6.7	3.3	5.7	.457	.891	.082	.077	.016	.015
6	42.00	7.4	3.6	6.3	.455	.922	.059	.055	.012	.011
7	50.00	7.7	3.6	7.0	.466	.930	.055	.053	.011	.011
8	70.00	8.7	3.6	10.1	.507	.901	.089	.089	.018	.018
9	80.00	8.2	2.8	10.0	.540	.916	.086	.086	.019	.019
10	90.00	8.3	2.8	10.2	.551	.933	.084	.084	.019	.019
11	95.00	11.6	6.4	15.1	.515	.966	.046	.046	.010	.010

TABLE VII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE ROTOR

(f) 80 Percent of design speed; reading 799

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-6.8	26.0	65.0	60.0	326.3	1.083	13.74	1.272
2	22.949	22.659	-7.2	25.9	64.3	57.9	324.5	1.085	13.76	1.291
3	21.849	21.653	-7.6	27.7	62.5	55.4	320.6	1.090	13.89	1.281
4	20.770	20.663	-6.8	28.5	61.5	53.7	319.5	1.085	13.80	1.291
5	20.142	20.096	-6.2	29.0	61.2	52.2	319.6	1.083	13.71	1.303
6	19.545	19.553	-6.0	29.9	60.8	50.4	319.8	1.083	13.66	1.314
7	18.885	18.959	-5.6	31.9	60.0	48.2	319.5	1.084	13.66	1.315
8	16.891	17.226	-6.6	35.9	58.0	39.4	317.0	1.091	13.72	1.324
9	15.804	16.330	-5.7	39.1	56.5	32.8	317.0	1.094	13.71	1.340
10	14.676	15.458	-3.7	42.7	56.5	24.2	317.9	1.096	13.66	1.344
11	14.084	15.032	-7.9	41.1	61.0	21.6	318.2	1.097	13.31	1.378

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	156.6	156.0	368.4	280.0	155.5	140.2	-18.6	68.4	315.4	310.8
2	159.9	162.9	365.3	276.1	158.6	146.6	-20.1	71.1	309.0	305.1
3	165.1	166.4	354.8	259.1	163.6	147.3	-21.7	77.3	293.1	290.5
4	162.9	165.2	338.5	245.4	161.8	145.3	-19.4	78.7	278.0	276.6
5	159.2	167.5	328.5	238.9	158.3	146.5	-17.3	81.2	270.5	269.9
6	156.8	170.3	320.0	231.5	156.0	147.6	-16.3	84.9	263.2	263.3
7	156.0	172.7	310.8	219.9	155.3	146.7	-15.2	91.2	254.0	255.0
8	153.7	184.5	288.0	193.4	152.7	149.4	-17.7	108.2	226.5	231.0
9	151.5	194.3	273.2	179.5	150.7	150.8	-15.2	122.4	212.6	219.7
10	136.9	206.3	247.5	166.4	136.7	151.7	-8.8	139.8	197.6	208.1
11	114.7	210.9	234.0	170.9	113.6	158.9	-15.7	138.7	189.0	201.7

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.441	.421	1.037	.756	.438	.379	.902	1.381
2	.452	.442	1.032	.748	.448	.397	.924	1.376
3	.470	.453	1.010	.706	.466	.401	.900	1.374
4	.464	.452	.965	.671	.461	.397	.898	1.357
5	.453	.459	.935	.654	.451	.401	.925	1.347
6	.446	.466	.910	.634	.444	.404	.946	1.337
7	.444	.473	.884	.603	.442	.402	.945	1.315
8	.439	.507	.822	.532	.436	.411	.979	1.276
9	.432	.535	.780	.494	.430	.415	1.000	1.221
10	.389	.569	.703	.459	.388	.418	1.110	1.138
11	.324	.582	.661	.472	.321	.439	1.399	1.183

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.4	.9	5.5	.329	.862	.073	.056	.014	.011
2	10.00	3.4	.9	4.2	.336	.887	.062	.047	.012	.009
3	20.00	3.4	.6	4.0	.368	.819	.106	.093	.021	.019
4	30.00	4.0	.9	5.2	.372	.893	.064	.055	.013	.011
5	36.00	4.8	1.4	5.6	.370	.948	.032	.026	.006	.005
6	42.00	5.5	1.7	6.0	.377	.983	.011	.006	.002	.001
7	50.00	5.7	1.6	6.5	.398	.966	.023	.021	.005	.004
8	70.00	6.4	1.3	8.1	.450	.916	.068	.068	.015	.015
9	80.00	5.7	.2	9.1	.475	.925	.069	.069	.015	.015
10	90.00	5.2	-.2	10.7	.477	.915	.095	.095	.021	.021
11	95.00	8.6	3.3	14.6	.427	.991	.011	.011	.002	.002

TABLE VII. - Concluded. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE ROTOR

(g) 80 Percent of design speed; reading 858

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.487	23.144	-7.6	19.0	64.7	60.5	321.4	1.070	13.18	1.217
2	22.949	22.659	-7.7	19.1	63.0	58.3	319.1	1.073	13.34	1.227
3	21.849	21.653	-7.8	18.8	60.9	56.1	316.4	1.072	13.43	1.225
4	20.770	20.663	-6.6	20.5	59.8	54.1	316.1	1.069	13.36	1.240
5	20.142	20.096	-6.5	21.6	59.5	52.1	316.2	1.070	13.24	1.258
6	19.545	19.553	-6.8	22.5	59.4	50.5	316.3	1.071	13.15	1.273
7	18.885	18.959	-6.1	24.4	58.1	48.0	316.5	1.073	13.22	1.276
8	16.891	17.226	-5.8	27.8	54.2	38.5	315.6	1.080	13.57	1.275
9	15.804	16.330	-6.1	30.3	52.5	31.7	316.0	1.086	13.60	1.300
10	14.676	15.458	-5.6	34.4	52.0	20.9	317.2	1.097	13.65	1.326
11	14.084	15.032	-12.6	30.4	56.7	20.8	317.7	1.097	13.35	1.363

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	160.8	155.8	372.6	299.0	159.3	147.3	-21.3	50.8	315.5	310.9
2	170.4	164.1	372.0	295.1	168.9	155.1	-22.8	53.7	308.6	304.7
3	178.4	167.6	363.2	284.6	176.8	158.6	-24.3	54.1	293.0	290.4
4	175.8	169.0	346.8	270.0	174.6	158.2	-20.1	59.3	279.5	278.1
5	170.8	171.6	334.6	260.0	169.7	159.6	-19.3	63.1	269.0	268.4
6	167.7	174.5	327.5	253.4	166.5	161.3	-19.9	66.7	262.1	262.2
7	170.0	179.0	320.3	243.8	169.1	163.1	-17.9	73.9	254.2	255.2
8	177.7	197.8	302.1	223.5	176.8	174.9	-17.9	92.4	227.0	231.5
9	178.3	210.9	291.0	214.0	177.3	182.1	-19.0	106.4	211.8	218.8
10	167.2	235.4	270.3	207.9	166.4	194.2	-16.3	133.0	196.7	207.2
11	149.1	242.5	265.3	223.8	145.5	209.2	-32.5	122.6	189.3	202.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.457	.427	1.058	.819	.453	.403	.924	1.380
2	.487	.451	1.063	.812	.483	.427	.918	1.347
3	.513	.464	1.045	.787	.509	.439	.897	1.329
4	.506	.469	.997	.749	.502	.439	.906	1.344
5	.491	.476	.961	.721	.487	.443	.940	1.328
6	.481	.484	.940	.703	.478	.447	.968	1.335
7	.488	.496	.919	.676	.485	.452	.965	1.308
8	.512	.550	.870	.622	.509	.487	.989	1.237
9	.513	.587	.838	.596	.510	.507	1.027	1.198
10	.479	.656	.774	.579	.477	.541	1.167	1.136
11	.425	.677	.756	.625	.414	.584	1.438	1.242

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	3.0	.5	6.0	.271	.831	.074	.056	.014	.010
2	10.00	2.2	-.3	4.6	.283	.828	.078	.063	.015	.012
3	20.00	1.7	-1.0	4.8	.292	.831	.078	.065	.015	.013
4	30.00	2.3	-.8	5.6	.298	.914	.041	.031	.008	.006
5	36.00	3.2	-.3	5.6	.303	.969	.016	.009	.003	.002
6	42.00	4.1	.3	6.1	.310	1.000	.000	-.006	.000	-.001
7	50.00	3.8	-.3	6.4	.327	.981	.011	.007	.002	.001
8	70.00	2.6	-2.5	7.2	.362	.897	.069	.068	.015	.015
9	80.00	1.6	-3.8	8.0	.378	.905	.072	.072	.016	.016
10	90.00	.7	-4.7	7.4	.368	.869	.124	.124	.028	.028
11	95.00	4.3	-.9	13.7	.295	.956	.044	.044	.010	.010

TABLE VIII. - BLADE-ELEMENT DATA AT BLADE EDGES

FOR SECOND-STAGE STATOR

(a) 100 Percent of design speed; reading 821

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	39.1	1.3	39.1	1.3	403.7	1.000	24.61	.978
2	22.598	22.636	40.0	1.6	40.0	1.6	402.0	1.000	24.74	.977
3	21.643	21.707	41.7	2.4	41.7	2.4	396.8	1.000	24.74	.979
4	20.711	20.798	39.9	1.8	39.9	1.8	391.2	1.000	24.62	.981
5	20.178	20.277	38.2	1.2	38.2	1.2	388.5	1.000	24.66	.980
6	19.670	19.782	36.8	.5	36.8	.5	386.8	1.000	24.65	.982
7	19.119	19.246	36.8	.7	36.8	.7	385.2	1.000	24.79	.981
8	17.501	17.678	40.6	-2.3	40.6	-2.3	379.1	1.000	24.44	.980
9	16.657	16.878	44.5	-.8	44.5	-.8	379.7	1.000	24.19	.985
10	15.832	16.106	49.1	2.6	49.1	2.6	382.7	1.000	24.56	.951
11	15.423	15.740	49.5	1.8	49.5	1.8	383.1	1.000	24.16	.941

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	210.3	165.1	210.3	165.1	163.1	165.1	132.7	3.6	.0	.0
2	213.6	167.2	213.6	167.2	163.7	167.1	137.2	4.7	.0	.0
3	217.9	168.0	217.9	168.0	162.6	167.8	145.0	7.0	.0	.0
4	217.8	166.6	217.8	166.6	167.0	166.5	139.8	5.2	.0	.0
5	219.9	166.6	219.9	166.6	172.9	166.5	135.9	3.5	.0	.0
6	221.7	167.9	221.7	167.9	177.6	167.9	132.7	1.5	.0	.0
7	226.0	170.0	226.0	170.0	180.9	170.0	135.5	2.1	.0	.0
8	227.2	168.9	227.2	168.9	172.4	168.8	148.0	-6.7	.0	.0
9	228.8	166.3	228.8	166.3	163.3	166.3	160.2	-2.2	.0	.0
10	241.1	152.8	241.1	152.8	157.8	152.7	182.4	6.9	.0	.0
11	237.7	133.1	237.7	133.1	154.5	133.1	180.7	4.3	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.537	.417	.537	.417	.417	.417	1.012	.938
2	.548	.424	.548	.424	.420	.424	1.021	.959
3	.563	.429	.563	.429	.420	.428	1.032	1.001
4	.567	.428	.567	.428	.435	.428	.997	.957
5	.575	.430	.575	.430	.452	.430	.963	.926
6	.582	.434	.582	.434	.466	.434	.945	.898
7	.595	.441	.595	.441	.476	.441	.940	.909
8	.603	.442	.603	.442	.458	.441	.979	.957
9	.607	.434	.607	.434	.434	.434	1.018	1.013
10	.640	.396	.640	.396	.419	.396	.968	1.133
11	.630	.344	.630	.344	.409	.343	.862	1.103

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	4.9	-.9	16.3	.454	.000	.122	.122	.048	.048
2	10.00	5.8	.1	15.0	.454	.000	.127	.127	.048	.048
3	20.00	7.6	1.9	13.8	.461	.000	.110	.110	.040	.040
4	30.00	5.7	.0	12.4	.451	.000	.096	.096	.034	.034
5	36.00	3.5	-2.1	11.6	.447	.000	.098	.098	.034	.034
6	42.00	1.5	-4.0	10.8	.439	.000	.088	.088	.029	.029
7	50.00	.9	-4.6	11.0	.439	.000	.091	.091	.030	.030
8	70.00	2.1	-3.2	8.4	.458	.000	.092	.092	.027	.027
9	80.00	3.6	-1.6	10.6	.473	.000	.068	.068	.019	.019
10	90.00	4.8	-.3	16.1	.560	.000	.203	.203	.055	.055
11	95.00	2.9	-2.2	17.2	.633	.000	.251	.251	.066	.066

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE STATOR

(b) 100 Percent of design speed; reading 872

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	43.2	1.4	43.2	1.4	404.6	1.000	24.64	.981
2	22.598	22.636	43.8	1.7	43.8	1.7	402.8	1.000	24.79	.977
3	21.643	21.707	43.6	2.2	43.6	2.2	396.8	1.000	24.80	.980
4	20.711	20.798	41.2	1.5	41.2	1.5	391.7	1.000	24.79	.981
5	20.178	20.277	39.9	.7	39.9	.7	389.6	1.000	24.73	.983
6	19.670	19.782	38.4	.1	38.4	.1	387.9	1.000	24.78	.982
7	19.119	19.246	37.9	.3	37.9	.3	386.2	1.000	24.96	.981
8	17.501	17.678	40.2	-1.9	40.2	-1.9	380.6	1.000	24.95	.979
9	16.657	16.878	43.8	-1.1	43.8	-1.1	380.5	1.000	24.47	.982
10	15.832	16.106	48.1	2.4	48.1	2.4	383.5	1.000	24.53	.957
11	15.423	15.740	47.4	2.0	47.4	2.0	384.3	1.000	24.53	.938

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	221.5	170.0	221.5	170.0	161.4	170.0	151.6	4.2	.0	.0
2	225.4	170.9	225.4	170.9	162.8	170.8	155.9	4.9	.0	.0
3	230.6	171.8	230.6	171.8	166.9	171.7	159.1	6.5	.0	.0
4	231.4	171.9	231.4	171.9	174.1	171.9	152.3	4.4	.0	.0
5	233.3	171.9	233.3	171.9	179.0	171.9	149.6	2.2	.0	.0
6	235.6	173.0	235.6	173.0	184.7	173.0	146.3	.2	.0	.0
7	241.1	175.9	241.1	175.9	190.2	175.9	148.2	.8	.0	.0
8	245.8	175.7	245.8	175.7	187.8	175.6	158.7	-5.7	.0	.0
9	243.6	168.2	243.6	168.2	176.0	168.1	168.5	-3.2	.0	.0
10	254.0	153.2	254.0	153.2	169.6	153.1	189.1	6.5	.0	.0
11	257.3	139.1	257.3	139.1	174.2	139.1	189.3	4.7	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.567	.430	.567	.430	.413	.430	1.053	1.072
2	.579	.433	.579	.433	.418	.433	1.049	1.094
3	.598	.439	.598	.439	.433	.439	1.029	1.105
4	.604	.442	.604	.442	.455	.442	.987	1.048
5	.611	.443	.611	.443	.469	.443	.961	1.023
6	.620	.447	.620	.447	.486	.447	.937	.994
7	.637	.456	.637	.456	.502	.456	.925	.998
8	.655	.459	.655	.459	.501	.459	.935	1.033
9	.649	.439	.649	.439	.469	.439	.956	1.070
10	.676	.397	.676	.397	.452	.396	.902	1.177
11	.685	.359	.685	.359	.464	.359	.798	1.154

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	9.1	3.3	16.5	.492	.000	.096	.096	.038	.038
2	10.00	9.8	4.0	15.2	.498	.000	.113	.113	.043	.043
3	20.00	9.7	4.0	13.7	.497	.000	.094	.094	.034	.034
4	30.00	7.0	1.4	12.2	.481	.000	.088	.088	.031	.031
5	36.00	5.4	-.2	11.3	.478	.000	.076	.076	.026	.026
6	42.00	3.3	-2.3	10.5	.472	.000	.078	.078	.026	.026
7	50.00	2.1	-3.4	10.6	.468	.000	.080	.080	.026	.026
8	70.00	1.8	-3.6	8.9	.483	.000	.085	.085	.025	.025
9	80.00	3.0	-2.2	10.4	.508	.000	.072	.072	.020	.020
10	90.00	3.9	-1.2	16.1	.589	.000	.164	.164	.044	.044
11	95.00	.9	-4.1	17.4	.646	.000	.232	.232	.061	.061

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE STATOR

(c) 100 Percent of design speed; reading 810

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	33.8	-.9	33.8	-.9	393.0	1.000	23.09	.979
2	22.598	22.636	34.1	-.0	34.1	-.0	389.6	1.000	23.12	.984
3	21.643	21.707	34.2	.4	34.2	.4	384.8	1.000	23.32	.984
4	20.711	20.798	34.6	.0	34.6	.0	382.1	1.000	23.23	.984
5	20.178	20.277	34.9	-.2	34.9	-.2	381.1	1.000	23.10	.986
6	19.670	19.782	34.6	-.6	34.6	-.6	380.2	1.000	23.10	.986
7	19.119	19.246	34.6	-.3	34.6	-.3	379.8	1.000	23.30	.987
8	17.501	17.678	36.3	-1.6	36.3	-1.6	377.0	1.000	23.85	.984
9	16.657	16.878	37.9	-1.5	37.9	-1.5	377.1	1.000	23.77	.985
10	15.832	16.106	41.9	1.3	41.9	1.3	379.2	1.000	23.44	.956
11	15.423	15.740	42.3	1.5	42.3	1.5	380.1	1.000	23.33	.938

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	213.6	174.1	213.6	174.1	177.5	174.0	118.9	-2.8	.0	.0
2	214.2	176.6	214.2	176.6	177.3	176.6	120.2	-.1	.0	.0
3	218.3	179.9	218.3	179.9	180.6	179.9	122.5	1.2	.0	.0
4	218.9	178.6	218.9	178.6	180.2	178.6	124.2	.0	.0	.0
5	218.2	176.8	218.2	176.8	178.8	176.8	124.9	-.7	.0	.0
6	219.7	177.6	219.7	177.6	180.7	177.6	124.9	-1.7	.0	.0
7	225.4	182.9	225.4	182.9	185.6	182.9	127.9	-.8	.0	.0
8	243.7	199.1	243.7	199.1	196.3	199.1	144.4	-5.4	.0	.0
9	245.0	197.2	245.0	197.2	193.2	197.2	150.6	-5.0	.0	.0
10	248.5	179.1	248.5	179.1	184.9	179.1	166.1	4.1	.0	.0
11	249.0	166.2	249.0	166.2	184.2	166.1	167.5	4.2	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.554	.447	.554	.447	.460	.447	.981	.857
2	.558	.456	.558	.456	.462	.456	.996	.858
3	.573	.468	.573	.468	.474	.468	.996	.861
4	.577	.466	.577	.466	.475	.466	.991	.859
5	.576	.462	.576	.462	.472	.462	.988	.854
6	.581	.464	.581	.464	.478	.464	.983	.845
7	.597	.479	.597	.479	.492	.479	.985	.855
8	.653	.526	.653	.526	.526	.526	1.014	.927
9	.656	.521	.656	.521	.518	.520	1.020	.938
10	.665	.469	.665	.469	.494	.469	.969	1.003
11	.665	.433	.665	.433	.492	.433	.902	.990

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-1.0	-6.8	13.5	.407	.000	.109	.109	.043	.043
2	10.00	-.6	-6.3	12.8	.390	.000	.086	.086	.033	.033
3	20.00	-.5	-6.2	11.2	.379	.000	.079	.079	.029	.029
4	30.00	-.2	-5.9	10.1	.383	.000	.080	.080	.028	.028
5	36.00	-.3	-5.8	9.6	.386	.000	.070	.070	.024	.024
6	42.00	-1.1	-6.7	9.2	.383	.000	.070	.070	.023	.023
7	50.00	-1.9	-7.4	9.4	.373	.000	.060	.060	.019	.019
8	70.00	-2.8	-8.1	8.5	.364	.000	.063	.063	.019	.019
9	80.00	-3.4	-8.7	9.4	.374	.000	.059	.059	.017	.017
10	90.00	-2.9	-8.1	14.3	.453	.000	.174	.174	.047	.047
11	95.00	-4.9	-9.9	16.3	.503	.000	.242	.242	.064	.064

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE STATOR

(d) 100 Percent of design speed; reading 833

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	25.8	-3.6	25.8	-3.6	379.3	1.000	20.09	.971
2	22.598	22.636	25.3	-3.6	25.3	-3.6	377.6	1.000	20.47	.971
3	21.643	21.707	24.5	-2.5	24.5	-2.5	372.8	1.000	20.74	.978
4	20.711	20.798	24.8	-2.4	24.8	-2.4	370.2	1.000	20.77	.979
5	20.178	20.277	25.4	-2.2	25.4	-2.2	369.6	1.000	20.67	.983
6	19.670	19.782	25.8	-2.3	25.8	-2.3	370.0	1.000	20.72	.983
7	19.119	19.246	26.6	-2.7	26.6	-2.7	370.6	1.000	20.85	.983
8	17.501	17.678	31.2	-3.4	31.2	-3.4	372.8	1.000	21.80	.981
9	16.657	16.878	32.6	-2.6	32.6	-2.6	375.2	1.000	22.55	.981
10	15.832	16.106	35.7	-.0	35.7	-.0	378.7	1.000	23.15	.951
11	15.423	15.740	35.7	-.9	35.7	-.9	379.0	1.000	23.15	.909

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	197.2	174.6	197.2	174.6	177.6	174.2	85.7	-11.1	.0	.0
2	206.7	184.6	206.7	184.6	186.9	184.3	88.3	-11.6	.0	.0
3	215.2	194.8	215.2	194.8	195.9	194.6	89.1	-8.6	.0	.0
4	215.3	196.5	215.3	196.5	195.5	196.3	90.4	-8.1	.0	.0
5	214.6	196.6	214.6	196.6	193.9	196.5	92.0	-7.5	.0	.0
6	216.3	198.4	216.3	198.4	194.7	198.3	94.2	-7.8	.0	.0
7	220.6	202.4	220.6	202.4	197.2	202.2	98.9	-9.5	.0	.0
8	248.7	227.7	248.7	227.7	212.6	227.3	129.0	-13.4	.0	.0
9	264.7	246.7	264.7	246.7	223.0	246.4	142.6	-11.3	.0	.0
10	280.9	247.1	280.9	247.1	228.1	247.1	164.0	-.2	.0	.0
11	282.4	229.6	282.4	229.6	229.2	229.6	165.0	-3.4	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.519	.457	.519	.457	.467	.456	.981	.668
2	.546	.485	.546	.485	.494	.484	.986	.680
3	.574	.517	.574	.517	.523	.516	.993	.671
4	.577	.523	.577	.523	.524	.523	1.004	.662
5	.575	.524	.575	.524	.520	.524	1.014	.662
6	.580	.529	.580	.529	.522	.529	1.019	.665
7	.592	.540	.592	.540	.529	.539	1.025	.684
8	.671	.610	.671	.610	.574	.609	1.069	.845
9	.716	.663	.716	.663	.603	.662	1.105	.901
10	.761	.661	.761	.661	.618	.661	1.083	.998
11	.765	.610	.765	.610	.621	.610	1.002	.979

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-8.5	-14.3	11.4	.306	.000	.171	.171	.067	.067
2	10.00	-8.8	-14.6	9.8	.291	.000	.155	.155	.059	.059
3	20.00	-9.6	-15.3	8.8	.261	.000	.111	.111	.041	.041
4	30.00	-9.5	-15.1	8.2	.247	.000	.104	.104	.036	.036
5	36.00	-9.3	-14.9	8.2	.242	.000	.086	.086	.029	.029
6	42.00	-9.4	-15.0	8.1	.239	.000	.083	.083	.028	.028
7	50.00	-9.3	-14.8	7.5	.241	.000	.081	.081	.026	.026
8	70.00	-7.3	-12.7	7.2	.254	.000	.074	.074	.022	.022
9	80.00	-8.2	-13.5	8.8	.232	.000	.065	.065	.018	.018
10	90.00	-8.6	-13.8	13.5	.276	.000	.154	.154	.042	.042
11	95.00	-10.9	-15.9	14.5	.342	.000	.285	.285	.075	.075

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE STATOR

(e) 80 Percent of design speed; reading 846

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	29.4	-.8	29.4	-.8	360.8	1.000	18.28	.983
2	22.598	22.636	31.3	.8	31.3	.8	360.2	1.000	18.33	.986
3	21.643	21.707	36.0	2.0	36.0	2.0	357.5	1.000	18.32	.990
4	20.711	20.798	37.2	1.5	37.2	1.5	354.0	1.000	18.41	.985
5	20.178	20.277	36.7	1.3	36.7	1.3	352.7	1.000	18.43	.985
6	19.670	19.782	36.1	.9	36.1	.9	351.6	1.000	18.44	.985
7	19.119	19.246	36.7	.7	36.7	.7	350.6	1.000	18.42	.988
8	17.501	17.678	39.5	-1.7	39.5	-1.7	347.9	1.000	18.36	.993
9	16.657	16.878	43.1	.7	43.1	.7	348.2	1.000	18.55	.987
10	15.832	16.106	47.2	3.6	47.2	3.6	350.1	1.000	18.64	.966
11	15.423	15.740	45.9	2.4	45.9	2.4	350.4	1.000	18.50	.956

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	163.0	131.7	163.0	131.7	142.0	131.7	80.0	-1.8	.0	.0
2	164.9	135.6	164.9	135.6	140.9	135.6	85.7	2.0	.0	.0
3	168.7	138.5	168.7	138.5	136.4	138.4	99.2	4.7	.0	.0
4	171.3	138.8	171.3	138.8	136.5	138.8	103.5	3.5	.0	.0
5	173.5	139.3	173.5	139.3	139.1	139.3	103.8	3.2	.0	.0
6	174.6	140.1	174.6	140.1	141.1	140.1	102.7	2.3	.0	.0
7	175.8	141.3	175.8	141.3	140.9	141.3	105.0	1.7	.0	.0
8	181.0	148.1	181.0	148.1	139.6	148.0	115.2	-4.4	.0	.0
9	189.0	150.6	189.0	150.6	138.1	150.6	129.0	1.8	.0	.0
10	199.5	141.8	199.5	141.8	135.6	141.5	146.3	9.0	.0	.0
11	198.3	129.6	198.3	129.6	138.1	129.5	142.4	5.4	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.436	.350	.436	.350	.380	.350	.927	.605
2	.442	.361	.442	.361	.378	.361	.963	.633
3	.454	.371	.454	.371	.367	.370	1.015	.707
4	.464	.373	.464	.373	.370	.373	1.016	.727
5	.471	.375	.471	.375	.378	.375	1.002	.724
6	.475	.378	.475	.378	.384	.378	.993	.710
7	.479	.382	.479	.382	.384	.382	1.003	.716
8	.496	.403	.496	.403	.383	.402	1.061	.755
9	.519	.409	.519	.409	.379	.409	1.091	.828
10	.548	.384	.548	.384	.372	.383	1.043	.919
11	.544	.350	.544	.350	.379	.349	.938	.872

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-5.7	-11.4	13.4	.388	.000	.135	.135	.053	.053
2	10.00	-3.6	-9.4	13.4	.371	.000	.110	.110	.042	.042
3	20.00	1.1	-4.6	12.5	.384	.000	.077	.077	.028	.028
4	30.00	2.1	-3.5	11.2	.394	.000	.109	.109	.038	.038
5	36.00	1.3	-4.3	10.9	.395	.000	.105	.105	.036	.036
6	42.00	.0	-5.5	10.4	.389	.000	.103	.103	.034	.034
7	50.00	-.0	-5.5	10.1	.386	.000	.079	.079	.026	.026
8	70.00	.2	-5.1	8.1	.377	.000	.046	.046	.014	.014
9	80.00	1.4	-3.8	11.3	.392	.000	.078	.078	.022	.022
10	90.00	2.0	-3.1	16.4	.473	.000	.184	.184	.049	.049
11	95.00	-1.5	-6.6	17.0	.526	.000	.242	.242	.064	.064

TABLE VIII. - Continued. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE STATOR

(f) 80 Percent of design speed; reading 799

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	25.4	-.3	25.4	-.3	353.3	1.000	17.48	.987
2	22.598	22.636	24.9	.0	24.9	.0	352.2	1.000	17.76	.981
3	21.643	21.707	26.2	-.8	26.2	-.8	349.3	1.000	17.79	.989
4	20.711	20.798	26.6	-1.3	26.6	-1.3	346.6	1.000	17.82	.990
5	20.178	20.277	27.0	-1.2	27.0	-1.2	346.0	1.000	17.87	.990
6	19.670	19.782	27.8	-1.0	27.8	-1.0	346.2	1.000	17.96	.987
7	19.119	19.246	29.6	-1.1	29.6	-1.1	346.4	1.000	17.96	.989
8	17.501	17.678	33.6	-2.0	33.6	-2.0	345.9	1.000	18.17	.993
9	16.657	16.878	37.0	-1.1	37.0	-1.1	346.9	1.000	18.38	.990
10	15.832	16.106	41.2	1.9	41.2	1.9	348.4	1.000	18.35	.970
11	15.423	15.740	40.3	1.5	40.3	1.5	349.0	1.000	18.34	.950

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	160.0	141.5	160.0	141.5	144.5	141.5	68.6	-.6	.0	.0
2	169.5	147.9	169.5	147.9	153.7	147.9	71.3	.0	.0	.0
3	175.2	154.3	175.2	154.3	157.2	154.3	77.4	-2.1	.0	.0
4	175.2	156.5	175.2	156.5	156.6	156.4	78.6	-3.6	.0	.0
5	177.9	157.9	177.9	157.9	158.5	157.9	80.9	-3.4	.0	.0
6	180.9	159.7	180.9	159.7	160.0	159.7	84.4	-2.9	.0	.0
7	182.9	161.6	182.9	161.6	159.0	161.6	90.4	-3.0	.0	.0
8	192.3	173.4	192.3	173.4	160.1	173.3	106.5	-6.1	.0	.0
9	199.6	178.4	199.6	178.4	159.5	178.4	120.0	-3.5	.0	.0
10	207.4	170.1	207.4	170.1	156.2	170.0	136.5	5.7	.0	.0
11	208.9	158.5	208.9	158.5	159.3	158.5	135.1	4.3	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID VEL R	PEAK SS MACH NO
1	.433	.381	.433	.381	.391	.381	.979	.531
2	.460	.400	.460	.400	.417	.400	.962	.543
3	.478	.419	.478	.419	.429	.419	.981	.570
4	.480	.427	.480	.427	.429	.427	.999	.565
5	.488	.432	.488	.432	.435	.431	.996	.572
6	.497	.436	.497	.436	.439	.436	.998	.587
7	.503	.442	.503	.442	.437	.442	1.016	.618
8	.530	.476	.530	.476	.441	.475	1.082	.690
9	.551	.489	.551	.489	.440	.489	1.118	.756
10	.572	.464	.572	.464	.431	.464	1.089	.835
11	.576	.431	.576	.431	.439	.431	.995	.806

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-10.1	-15.8	13.5	.285	.000	.109	.109	.043	.043
2	10.00	-10.5	-16.2	12.2	.288	.000	.141	.141	.054	.054
3	20.00	-9.1	-14.8	9.4	.285	.000	.077	.077	.028	.028
4	30.00	-8.8	-14.5	8.1	.271	.000	.065	.065	.023	.023
5	36.00	-8.8	-14.4	8.0	.274	.000	.069	.069	.024	.024
6	42.00	-8.6	-14.2	8.1	.278	.000	.084	.084	.028	.028
7	50.00	-7.5	-13.0	8.0	.281	.000	.071	.071	.023	.023
8	70.00	-6.1	-11.5	7.4	.271	.000	.039	.039	.012	.012
9	80.00	-5.1	-10.3	9.0	.280	.000	.056	.056	.016	.016
10	90.00	-4.4	-9.5	14.3	.348	.000	.149	.149	.040	.040
11	95.00	-7.5	-12.5	15.7	.404	.000	.249	.249	.065	.065

TABLE VIII. - Concluded. BLADE-ELEMENT DATA AT

BLADE EDGES FOR SECOND-STAGE STATOR

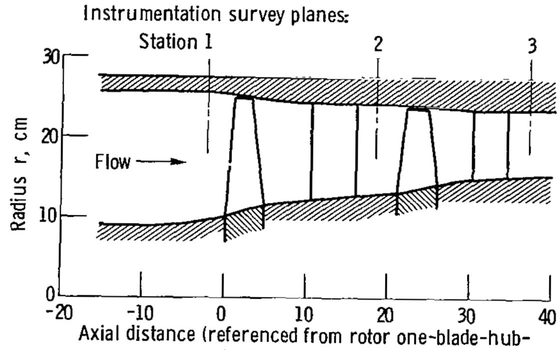
(g) 80 Percent of design speed; reading 858

RP	RADII IN	RADII OUT	ABS BETAM IN	ABS BETAM OUT	REL BETAM IN	REL BETAM OUT	TOTAL TEMP IN	TOTAL TEMP RATIO	TOTAL PRESS IN	TOTAL PRESS RATIO
1	23.068	23.089	18.5	-.0	18.5	-.0	343.8	1.000	16.04	.976
2	22.598	22.636	18.3	.6	18.3	.6	342.3	1.000	16.37	.978
3	21.643	21.707	17.7	1.3	17.7	1.3	339.1	1.000	16.46	.976
4	20.711	20.798	19.1	1.4	19.1	1.4	338.1	1.000	16.57	.972
5	20.178	20.277	19.9	2.0	19.9	2.0	338.3	1.000	16.65	.973
6	19.670	19.782	20.7	2.4	20.7	2.4	338.9	1.000	16.74	.973
7	19.119	19.246	22.4	1.8	22.4	1.8	339.7	1.000	16.86	.984
8	17.501	17.678	25.7	-2.2	25.7	-2.2	340.9	1.000	17.30	.983
9	16.657	16.878	28.3	-2.1	28.3	-2.1	343.2	1.000	17.69	.978
10	15.832	16.106	32.9	1.3	32.9	1.3	347.9	1.000	18.11	.969
11	15.423	15.740	29.6	1.5	29.6	1.5	348.5	1.000	18.19	.928

RP	ABS VEL IN	ABS VEL OUT	REL VEL IN	REL VEL OUT	MERID VEL IN	MERID VEL OUT	TANG VEL IN	TANG VEL OUT	WHEEL SPEED IN	WHEEL SPEED OUT
1	160.2	153.6	160.2	153.6	151.9	153.6	50.9	-.1	.0	.0
2	171.5	165.4	171.5	165.4	162.9	165.4	53.8	1.8	.0	.0
3	178.2	171.3	178.2	171.3	169.7	171.2	54.1	4.0	.0	.0
4	181.1	173.2	181.1	173.2	171.2	173.1	59.2	4.3	.0	.0
5	184.3	176.3	184.3	176.3	173.3	176.2	62.9	6.2	.0	.0
6	187.7	180.7	187.7	180.7	175.6	180.5	66.3	7.6	.0	.0
7	192.1	188.9	192.1	188.9	177.6	188.8	73.3	5.9	.0	.0
8	209.5	209.4	209.5	209.4	188.8	209.2	90.9	-8.0	.0	.0
9	220.4	222.9	220.4	222.9	194.1	222.8	104.3	-8.3	.0	.0
10	239.3	227.9	239.3	227.9	201.0	227.9	129.9	5.3	.0	.0
11	241.7	214.3	241.7	214.3	210.0	214.2	119.5	5.7	.0	.0

RP	ABS MACH NO IN	ABS MACH NO OUT	REL MACH NO IN	REL MACH NO OUT	MERID MACH NO IN	MERID MACH NO OUT	MERID PEAK SS VEL R	PEAK SS MACH NO
1	.439	.421	.439	.421	.417	.421	1.011	.439
2	.473	.455	.473	.455	.449	.455	1.015	.473
3	.494	.474	.494	.474	.471	.474	1.009	.494
4	.504	.481	.504	.481	.476	.480	1.011	.504
5	.513	.490	.513	.490	.482	.489	1.017	.513
6	.522	.502	.522	.502	.489	.501	1.028	.522
7	.535	.525	.535	.525	.494	.525	1.063	.535
8	.585	.585	.585	.585	.527	.584	1.108	.585
9	.616	.623	.616	.623	.542	.623	1.148	.616
10	.668	.634	.668	.634	.561	.634	1.134	.765
11	.675	.593	.675	.593	.586	.592	1.020	.675

RP	PERCENT SPAN	INCIDENCE MEAN	INCIDENCE SS	DEV	D-FACT	EFF	LOSS COEFF TOT	LOSS COEFF PROF	LOSS PARAM TOT	LOSS PARAM PROF
1	5.00	-19.6	-25.4	11.1	.165	.000	.190	.190	.074	.074
2	10.00	-19.8	-25.5	10.1	.152	.000	.158	.158	.060	.060
3	20.00	-20.3	-26.0	8.8	.142	.000	.158	.158	.058	.058
4	30.00	-19.1	-24.7	8.1	.150	.000	.175	.175	.061	.061
5	36.00	-18.6	-24.2	8.5	.148	.000	.162	.162	.055	.055
6	42.00	-18.5	-24.0	8.8	.141	.000	.160	.160	.053	.053
7	50.00	-14.9	-20.4	10.6	.130	.000	.093	.093	.030	.030
8	70.00	-14.2	-19.6	7.0	.140	.000	.082	.082	.024	.024
9	80.00	-14.0	-19.2	7.9	.132	.000	.096	.096	.027	.027
10	90.00	-12.9	-18.0	13.5	.187	.000	.122	.122	.033	.033
11	95.00	-18.4	-23.4	15.5	.236	.000	.273	.273	.072	.072



Flow path coordinates

Axial distance Z, cm	Radius r, cm	
	Outer	Inner
-15.237	25.654	8.994
-10.160	25.654	8.903
-5.080	25.654	9.093
[a]-2.347	25.651	9.543
0	25.570	10.160
2.540	25.128	10.973
5.080	24.681	11.565
7.620	24.460	11.902
10.160	24.384	12.139
12.700		12.438
15.240		12.822
17.780		13.025
[a]18.659		13.038
20.320	24.328	13.152
22.860	23.993	13.627
25.400	23.655	14.371
27.940	23.622	14.699
30.033		14.849
34.610		15.237
[a]36.706		15.240
40.640		15.240

[a]Instrumentation survey plane

Figure 1. - Fan flow path.

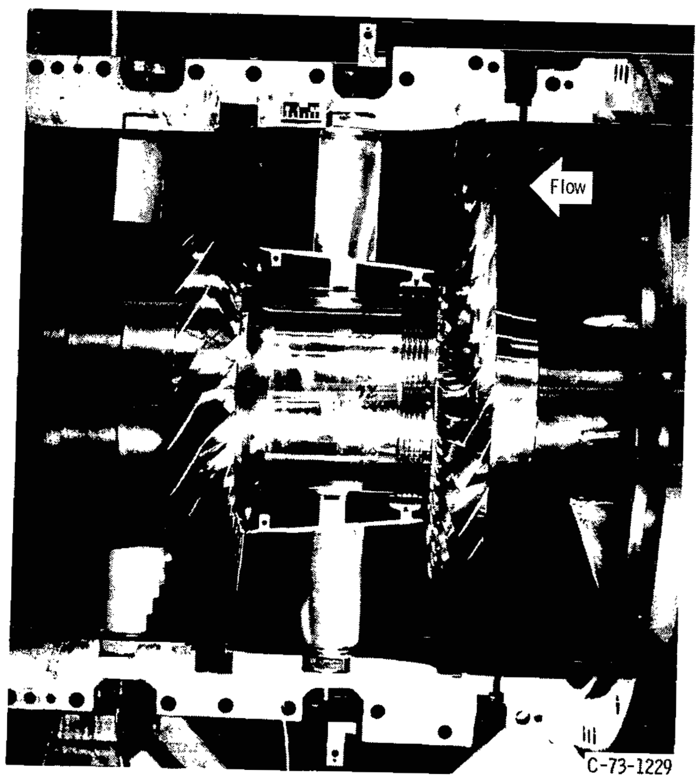


Figure 2. - Two-stage fan assembly (shown prior to installation of casing treatment).

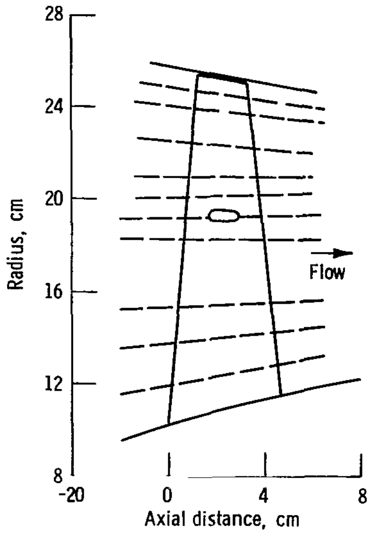


Figure 3. - First-stage rotor design streamlines.

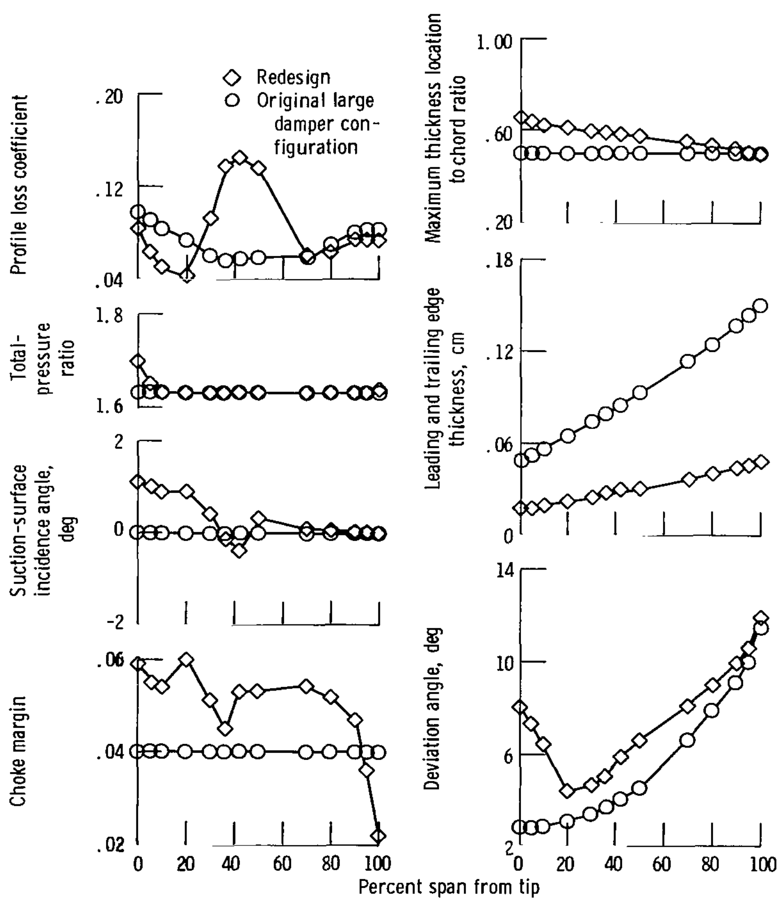


Figure 4. - Radial distributions of design parameter for first-stage rotors.

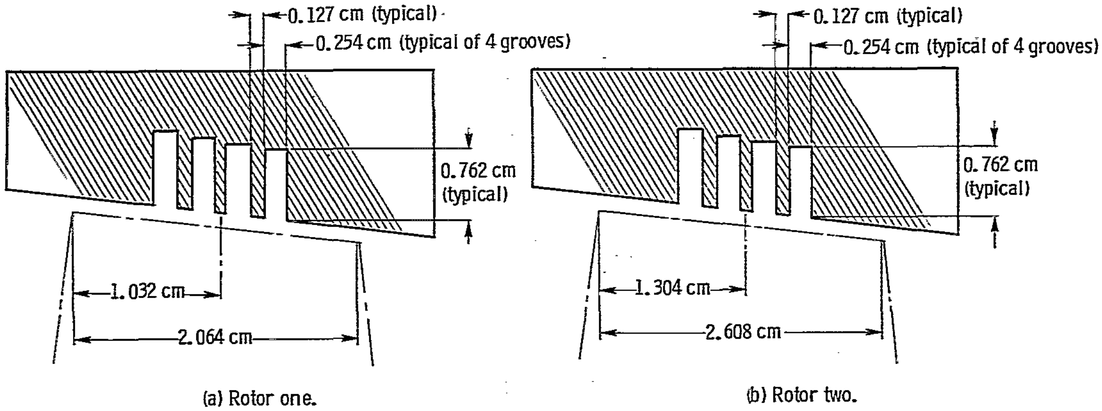


Figure 5. - Circumferentially grooved casing treatment.

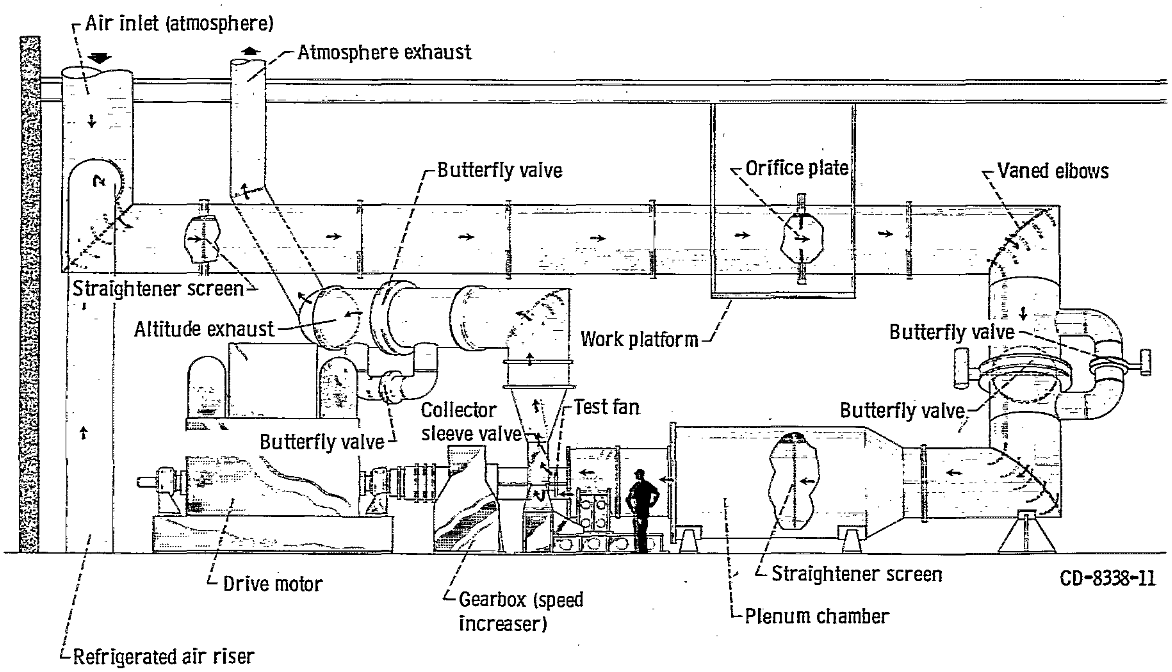


Figure 6. - Multistage compressor test facility.

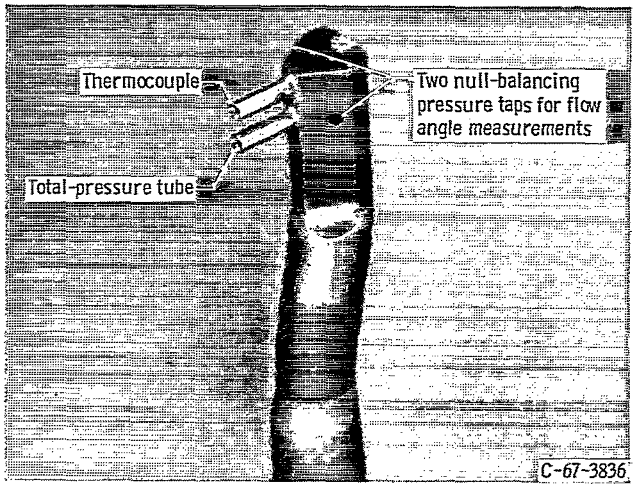


Figure 7. - Combination total-pressure, total-temperature, and flow-angle probe (double barrel).

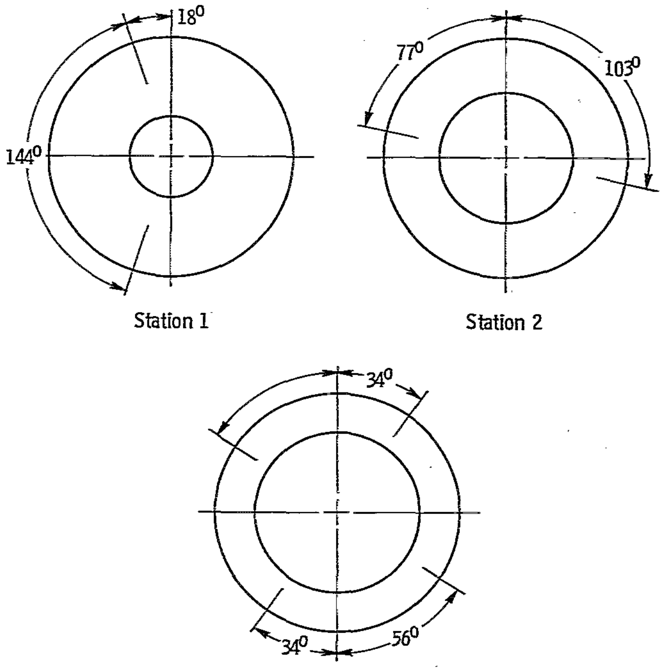
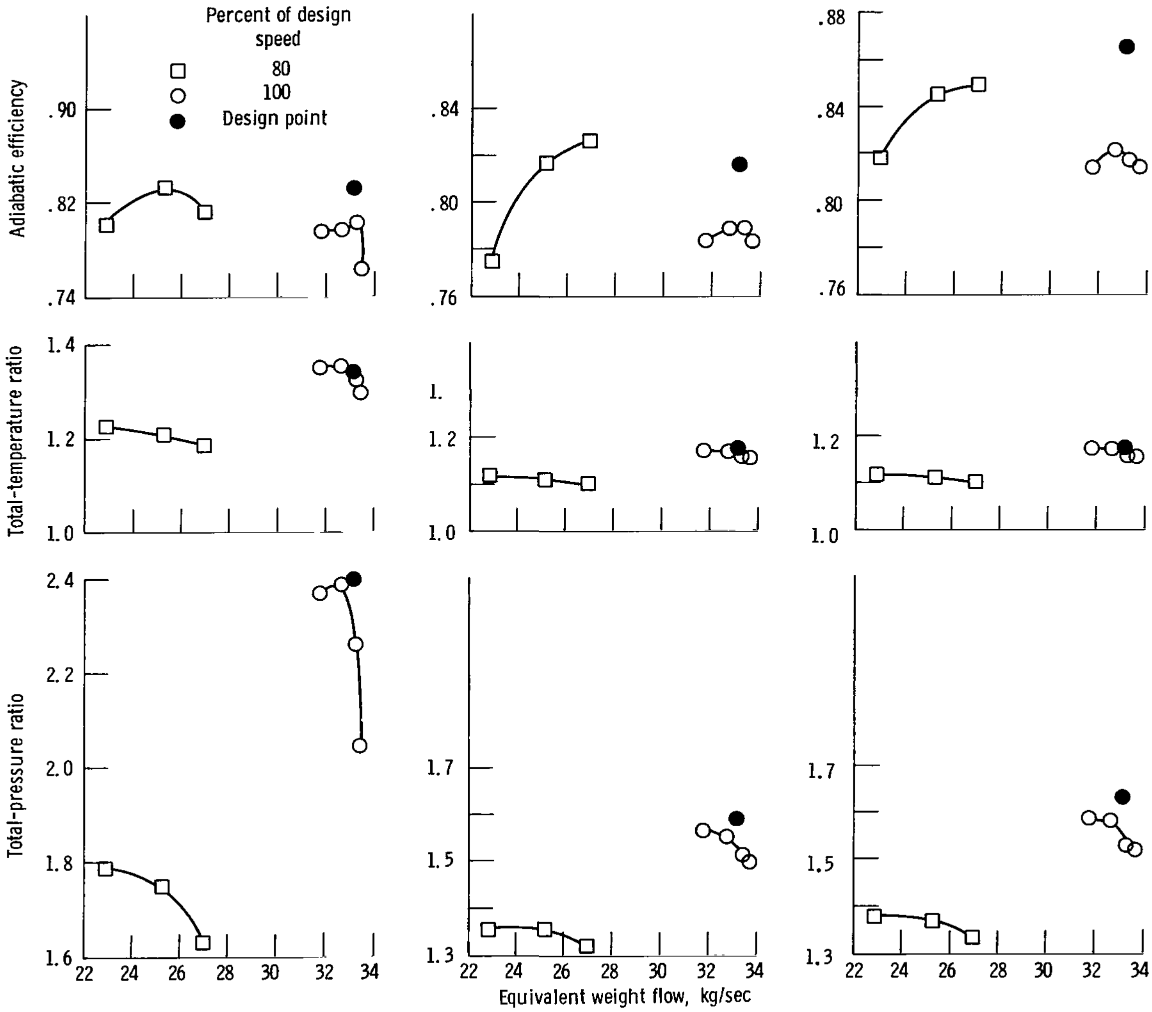


Figure 8. - Circumferential locations of combination probes (looking downstream; clockwise rotation).



(a) Two-stage fan. (b) First stage. (c) First-stage rotor.

Figure 9. - Overall performance.

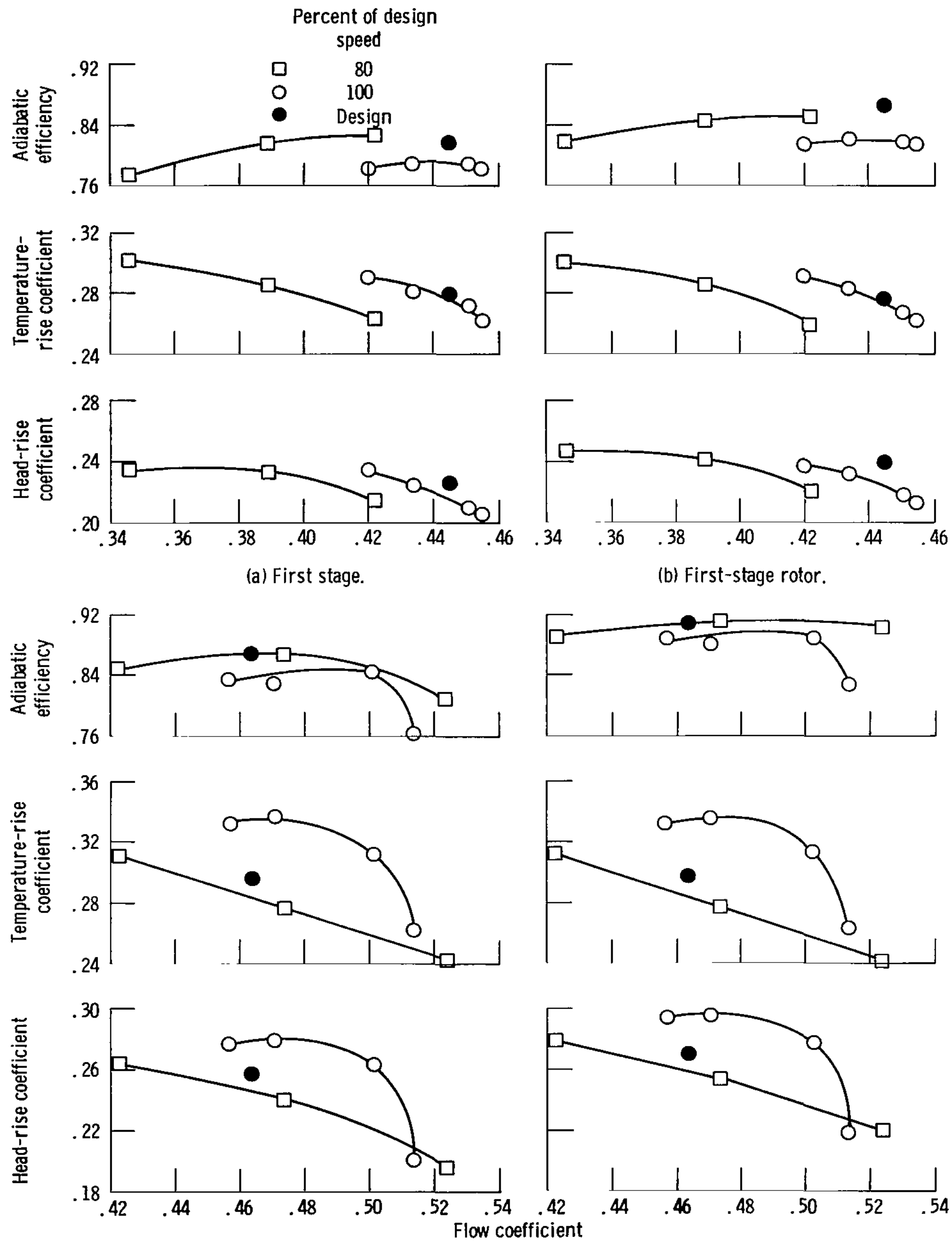


Figure 10. - Nondimensional overall performance.

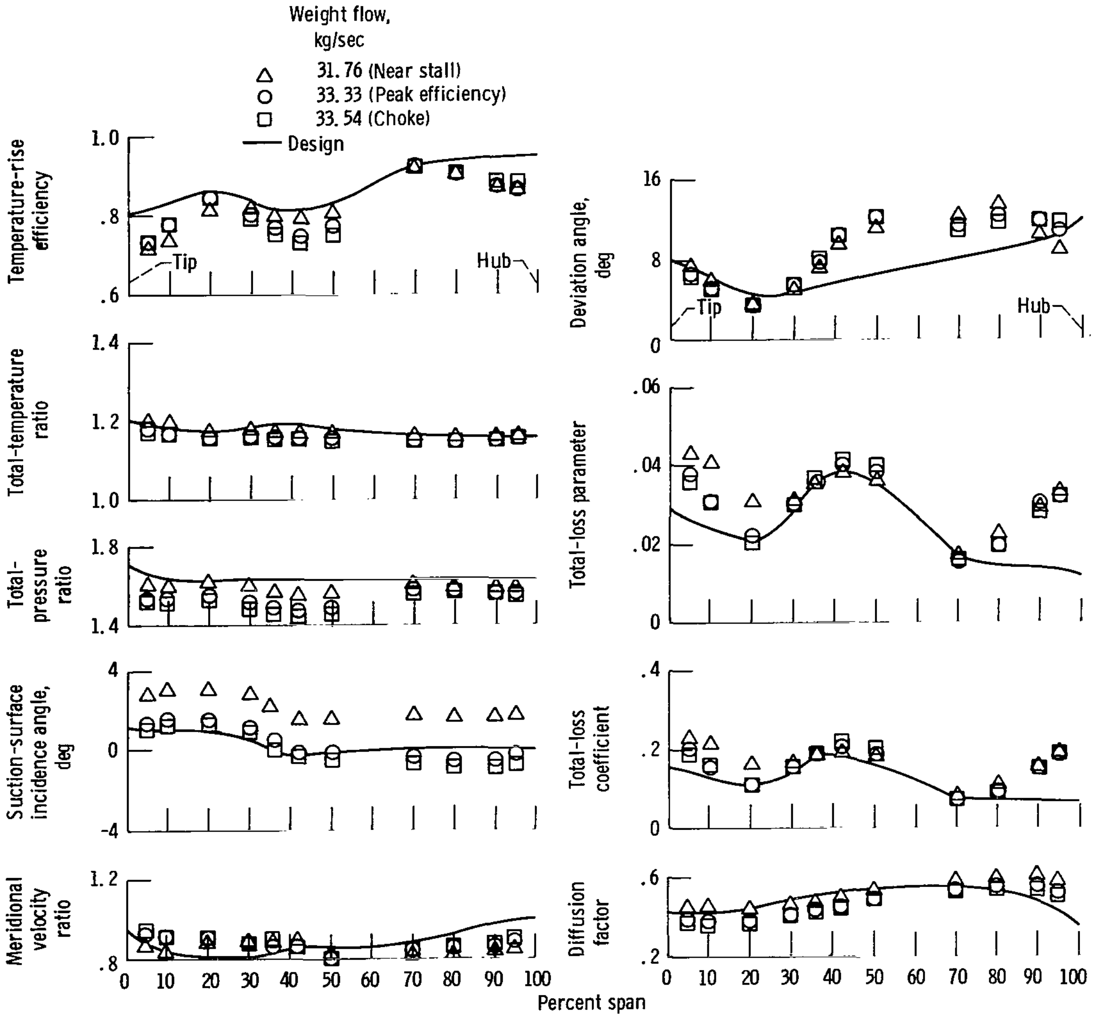


Figure 11. - Radial distribution of performance parameters for rotor 1 at design speed.

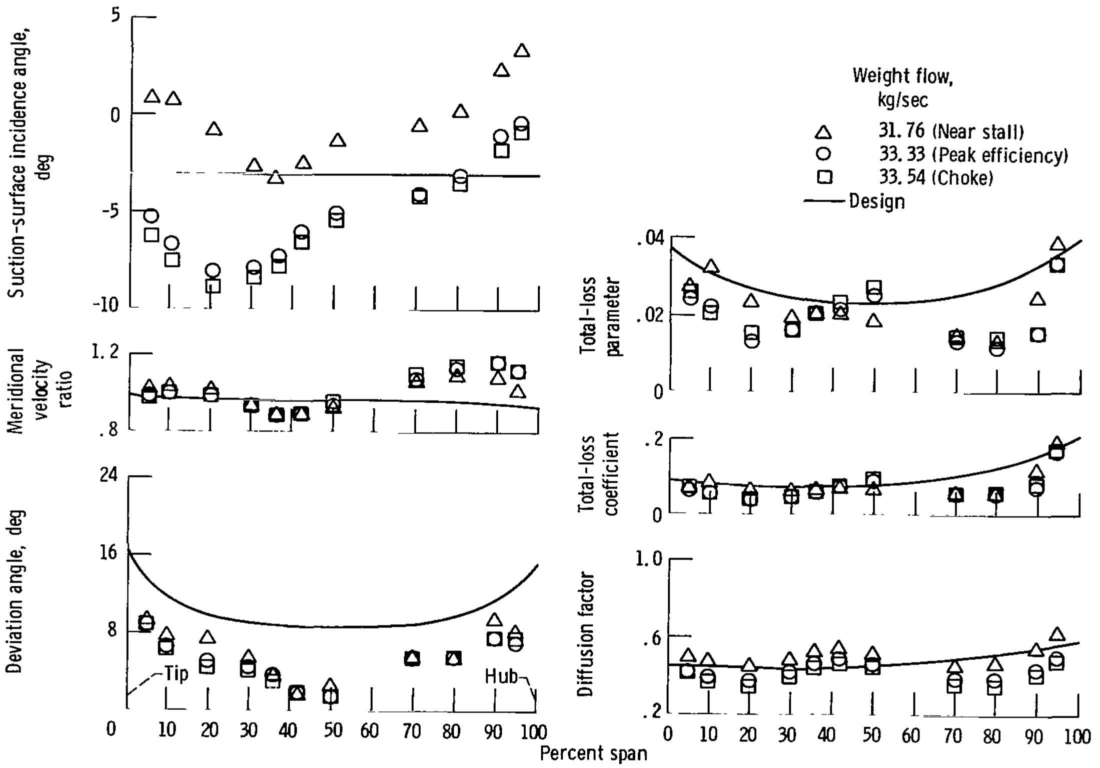


Figure 12. - Radial distribution of performance parameters for first-stage stator at design speed.

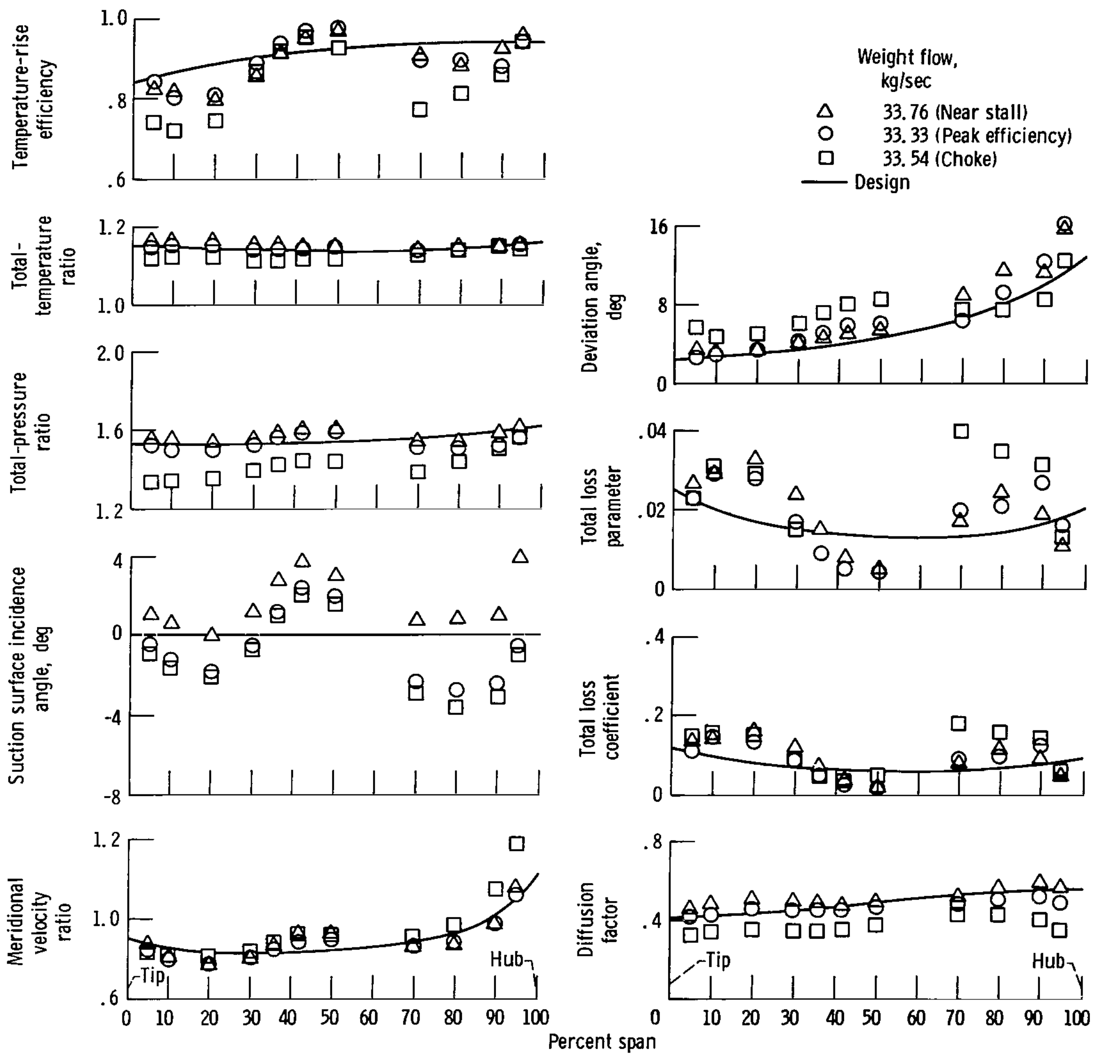


Figure 13. - Radial distribution of performanance at 100 percent design speed for second-stage rotor.

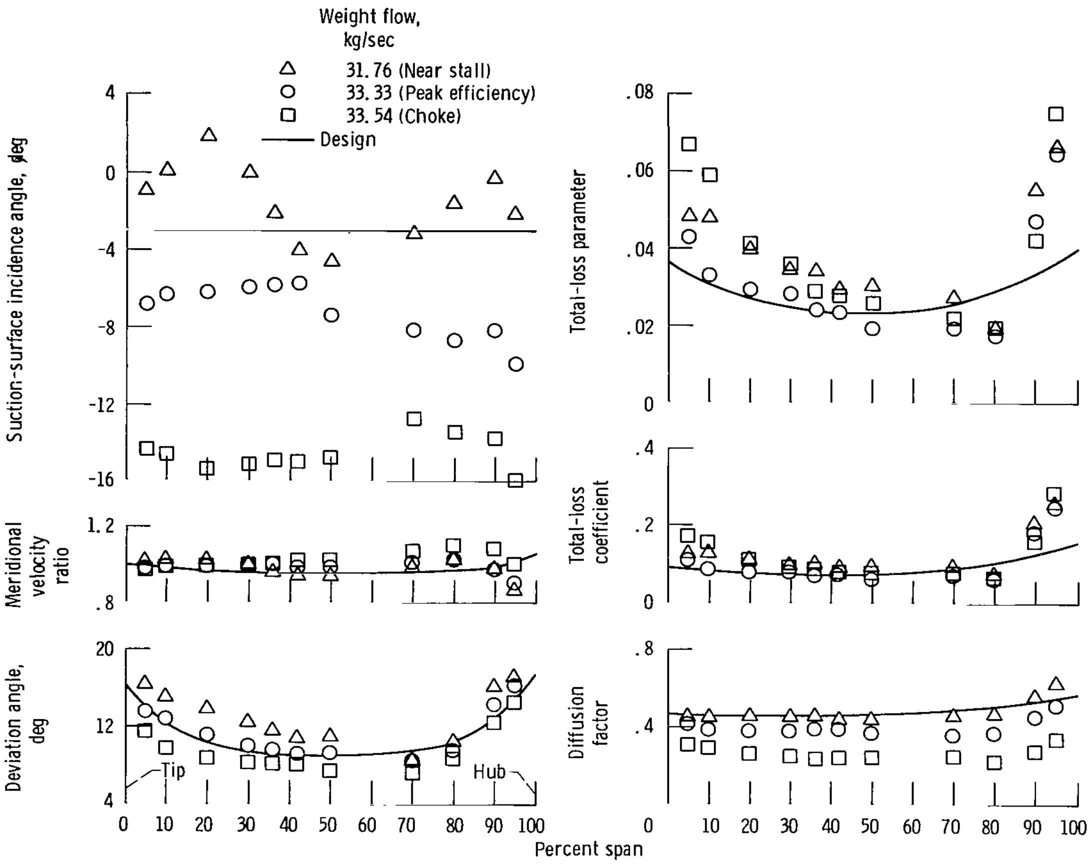
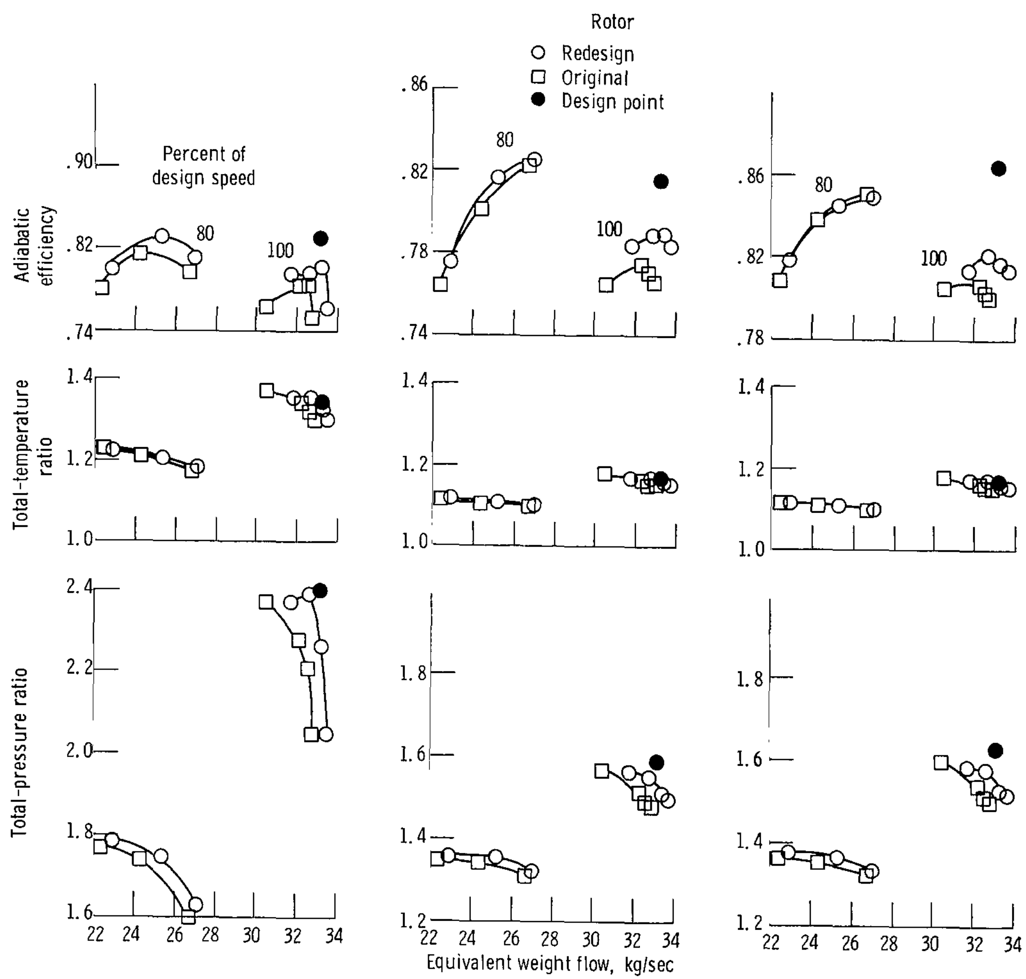


Figure 14. - Radial distribution of performance parameters for second-stage stator at design speed.



(a) Two-stage fan.
(b) First stage.
(c) First-stage rotor.

Figure 15. - Comparison of overall performances of original, large damper and redesigned configurations.

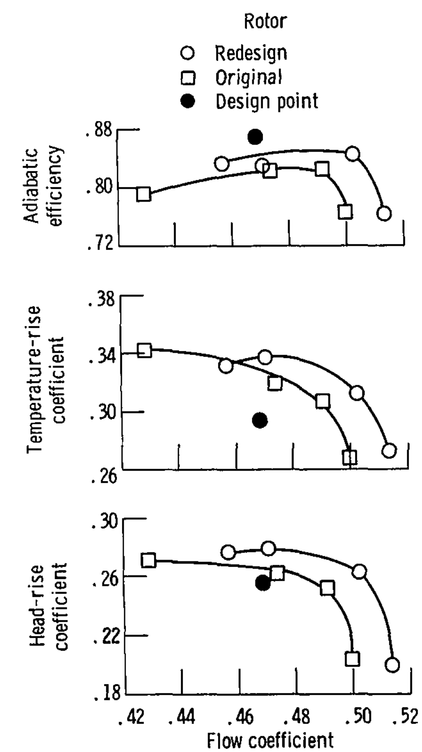


Figure 16. - Comparison of non-dimensional overall performance of second stage.

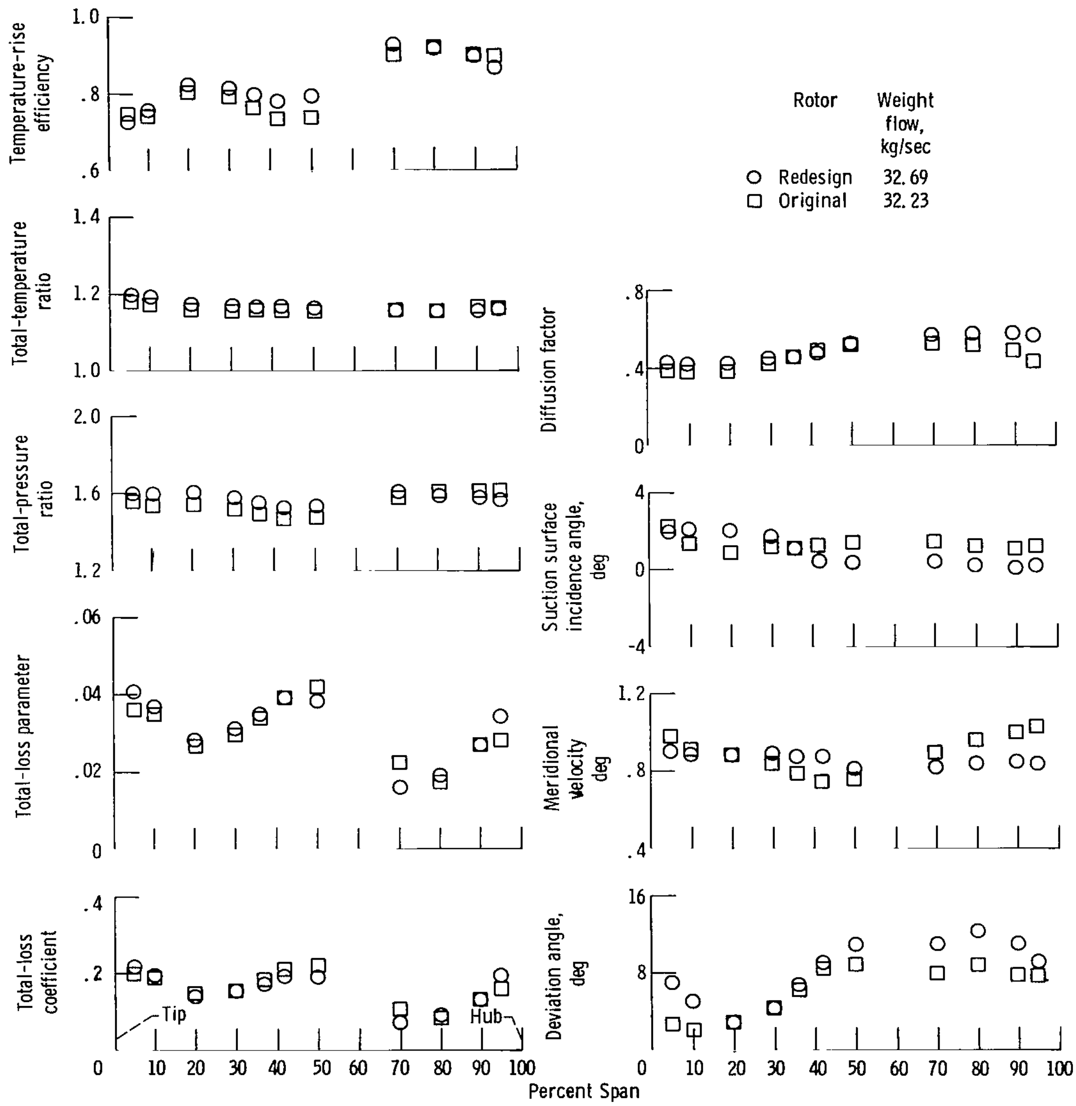


Figure 17. - Comparison of radial distributions of performance parameters for rotor 1.

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16. Abstract

The NASA two-stage fan was tested with a redesigned first-stage rotor. The redesign included a new design approach to account for the presence of a part-span damper. At design speed the fan achieved a peak efficiency of 0.803, which is 1.9 percentage points higher than the original design. The peak efficiencies of the first stage and first rotor were 0.789 and 0.821, respectively. An improvement in efficiency of up to 5 percentage points in the damper region was achieved over the original large damper version. The stall margin, based on flow conditions at peak efficiency, was 10 percent at design speed.

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